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The Abyssinian War

Mechanization Was The Basis of Italian Superiority

By Liddell Hart*

THE main lessons of the war in Abyssinia now have been elucidated by postwar evidence from both sides, and it is clear that they have an important bearing on the problem of future warfare. The course of the war did not run according to common expectation, and the situation after the first three months encouraged such excessive confidence in the Abyssinians' capacity for resistance that the dramatically swift ending of the main campaign tended to magnify the impression of surprise in the public mind. The Italians themselves have admitted that they had not foreseen the plight in which they found themselves at the end of 1935, nor such rapid and extensive success as ultimately crowned their efforts. Yet it was a war where the determining factors and conditions worked out, on the whole, in a way remarkably true to their calculable properties. That fact is an encouragement to those who believe that there is value in applying what is called the scientific method to the study of war, and that by its use it should be possible to gauge the general current and the local eddies with reasonable accuracy—instead of seeing them as the sport of accident and opportunism, and submitting fatalistically to the opinion that every new war must find us unprepared for its conditions.

If the study of war in the past has so often proved fallible as a guide to the course and conduct of the next war, it does not imply that war is not suited to scientific study, but that the study has not been scientific enough in spirit and method. Looking back on the past, it hardly would seem possible that the authoritative schools of military thought could have misunderstood as completely as they did the evolution which was so consistently revealed throughout the wars of the late nineteenth and early twentieth centuries. Reviewing the record of error it seems only capable of explanation by the conclusion that their study of war was subjective, not objective—that they went to military history to find texts for their sermons, instead of facts for analysis. That conclusion has been strengthened by experience in trying to estimate the probable course of the Abyssinian War. Here the conditions were so peculiar and unknown factors so numerous, that few students could hope to treat the problem with the measure of apparently assured knowledge that was available in recent European wars. It remained to be seen how far the margin of error could be minimized by examining the coming war purely as a problem, without preconceptions and preferences, guided only by a general understanding of recent trends in the evolution of warfare. For my own part I had to attempt such an estimate in the early summer of 1935, and it may be of interest because of the bearing on the question just discussed, to reproduce the bulk of it as it appeared in *The Times* (London) before passing on to discuss what actually happened. The retrospective view can thus be compared with the prospective. Following is the situation as I regarded it in prospect.

FROM a military point of view, the Abyssinian problem may be focused in a single word—"Adowa." Perhaps more exactly in a phrase—"The memory of Adowa." I do not refer here to the part that was played by the memory of this 39-year-old defeat in fomenting Italian irritation and increasing determination to attain results that will wipe out the memory. That factor lies in the political sphere, even though it may find expression in the military.

The military influence of "Adowa" lies mainly in its effect upon the attitude and action of the Abyssinians. If it came to a test, would they prove to be intoxicated by that memory of victory over the Italian forces and imagine that 1896 could be repeated in the conditions of 1935? Would they, in that intoxication, fail to realize that their best hope of successful resistance lies in playing the guerilla game from the outset?

The Abyssinians' most serious danger lies in the possibility that they would, in false confidence, or under the sting of a loss of territory, assemble in mass to oppose the invaders near the frontier. In that case they would offer a promising target to the bombs of the Italian aircraft and in some areas to the thrusts of mechanized forces. They might even be tempted into launching attacks in vain gallantry against the Italian machine guns. Omdurman might be repeated. The student of military history appreciates how easily, with a little cunning, the Sudanese might have made things awkward for us in the advance to Khartoum. Instead, by excess of courage they played into our hands and by their massed advance in daylight, offered themselves up as a sacrificial demonstration of the effect of fire power. At the worst, more tactical sense is to be expected of the Abyssinians; but fire power has developed more in the past thirty years than any improvement in tactics can overtake. The only chance for the ill-equipped nowadays lies in guerilla tactics. Information from some sources makes it doubtful whether the Abyssinians have realized this essential truth, and are of a mind to act upon it. "Adowa" may prove stronger than reason.

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If the Abyssinians should be so unwise as to present a target to modern weapons, the consequences of a crushing disillusionment are not easy to predict. Its ripples might spread wide. When considering the possible effect of concentrated air bombing on such an unacclimatized people, one recalls the reaction which the Arabs suffered, on the other side of the Red Sea, when they first made contact with artillery fire during the revolt in the Hejaz against the Turks. The shells which exploded among them were nothing compared with the weight of explosive that the Italian aircraft could drop upon the Abyssinians today.

The Japanese have shown in Manchuria how air bombardment may pave the way for the advancing troops, serving as a longer-range and more flexible substitute for the artillery barrage of the last war. It is likely that this method will be the Italians' strongest card, with tanks as a secondary agent, in forcing the evacuation of points where a prolonged delay might otherwise be imposed. But the further the advance progresses and the less the defenders offer a target, the greater the handicap in obtaining the full effect of these new tools.

IF THE Abyssinians were wise enough to adopt guerilla methods from the outset, one does not envy the Italian commanders the problem that they would be called on to solve, especially if they aimed at the complete subjugation of the country—and such a country, topographically. The rugged plateau with its towering escarpment might be likened to the medieval castle of a giant's dream. Approaches are few and difficult, being fortified by nature with successive moats and barricades, while the communications of an advancing force would be as hard to safeguard as to create. "Air pressure" on the defender's keep would not offer the promise of effect that this new form of the rear attack holds out in other parts of the world, even in similarly decentralized and unindustrialized states. Addis Ababa, the capital, is over 400 miles distant from the Italian bases in Eritrea and stands over 8000 feet above sea level; as a bombing target it would thus seem to be well out of reach of present service aircraft. The air problem might be diminished as the Italian land forces advance more deeply into the country—but the further they go the harder may become their military problems. The effective subjugation of a country largely depends on having targets that can be smitten effectively. Here, targets will be few unless the Abyssinians carelessly offer them. And nothing is more nerve-wracking for an army of occupation than the intangible ubiquity of a guerilla foe who is operating in his own country with room enough to play the game of watchful waiting until the time is ripe for a sudden, stabbing attack.

But it is far more difficult to change to guerilla methods after a shattering reverse. Here is the risk that the Abyssinians run in remembering Adowa too well. It is true that the Spaniards succeeded in making such a change against the Napoleonic armies after their own regular forces had been smashed. But they had Wellington to support them and by his intervention gained time and space for their guerillas to sprout throughout the countryside. And that successful change of methods was achieved more than a century ago; nowadays, air power and mechanization tend to accelerate the exploitation of victory over a congregated force and jeopardize the chances of rallying the survivors to harass, where they cannot directly resist, the invaders' progress. Moreover, the nerve shock of a new weapon is apt to have the deepest echo among a primitive people.

SUCH knowledge as we have of the forces and equipment of the Abyssinians strengthens the impression that it would be foolish for them to embark upon an imitation of modern warfare. The number of "regular" troops of whom the Emperor might dispose is not likely to amount to more than forty thousand, and although levies amounting to more than half a million might be available to oppose an invasion that threatened the heart of the country, such numbers would have little value except for guerilla warfare, even if the miracle of keeping them supplied could be performed. The modern Abyssinian artillery is said to include only some three batteries of 75's. Beyond this, it is made up of a number of "elephant guns" and a hundred or more ancient pieces. Mortars may be counted on the fingers, as may aircraft and tanks. Machine guns probably total about three hundred, with double that number of automatic rifles—the Arab revolt showed the essential value of these even for guerilla warfare, and an increase is certainly one of the Abyssinians' most urgent needs, together with adequate ammunition.

The time the Ethiopians have had for training may not prove altogether an advantage, if one may take as having any general application some recent reports as to the well-drilled state of these troops. That type of training runs the risk of paralyzing their natural fighting instincts and leaving them an easy target. Primitive man knows how to fight with cunning, but if you put him through a long course of drill one may do no more than develop "tactical arthritis." To counter the modern weapons of their assailants, the Ethiopians do not need similar heavy weapons any more than they need European drill, but they certainly require an adequate quantity of light machine guns and small-arm ammunition. These are the material foundation of guerilla tactics against a modern army, as Lawrence of Arabia diagnosed and demonstrated a generation ago on the other side of the Red Sea.

By contrast, we may reckon that modern armament will give to the Italian troops a fighting value much greater than their actual numbers. The extent of these is not certain, but a short time ago it was reported that there was one white division in Eritrea, with the equivalent of three native divisions; and another white division in Somalia together with a native division. It is probable that about a hundred thousand men have been dispatched from the Mediterranean, and although the shipments have dwindled recently, during the bad season, it is likely that the numbers would be increased before operations open. A division in Sardinia has been standing by for some time. The Italian forces are said to include a considerable quantity of tanks and mechanized transport, as well as several hundred aircraft.

In estimating the possible courses which the Italian forces may adopt, much depends on their object. If they are aiming at the conquest of Abyssinia, the decisive invasion would, in normal expectation, be made from Eritrea. In this case, a main advance from Massawa southward upon Magdala, to bring the Abyssinians to battle, might be accompanied by a flank advance from the southern corner of Eritrea upon the rear of the defending forces. If there is no base in this corner capable of maintaining large forces, the route itself is more suitable to the movement of mechanized troops than along the difficult direct route of advance through the precipitous country between Massawa and Magdala.

This combined advance from Eritrea might well be preceded by a further advance on the southern borders of Abyssinia, executed by the Italian forces in Somalia. It would serve

to draw off the Abyssinians' attention and forces, especially if the threat went far enough and was directed against Harrar, the Emperor's own province. Thus I wrote in *The Times* in the early summer of 1935.

The kernel of one's "appreciation" was packed into a nutshell by a Canadian caption writer who put these headlines on an interview I gave his newspaper on September 4th: "Adowa Illusion May Decide War Says Strategist. Mass attacks will mean annihilation for Abyssinians, Liddell Hart predicts." In that interview I also suggested that the Italians might find scope for their aircraft, apart from the normal military functions, in supplying their advanced columns as well as in a progressive demoralization of the population behind the front.

This, then, was the prospect before actual warfare began. With recorded facts before us, let us now consider the war in retrospect.

THE invasion began on October 2, 1935. The main Italian forces, three army corps, moved southward from Eritrea as expected. On the 6th, after a short advance, they captured Adowa without meeting serious opposition. The Ethiopians, following the wise admonitions of the Emperor, continued to show a promising restraint in checking the impulse to attack which "the memory of Adowa" might have caused. The Italians began to suffer trouble with their communications, and a pause of some weeks occurred. Short advances took place on the Somalia front in the south, and also from the southern corner of Eritrea, but were slow to develop further. Air bombing, however, began to produce some ominous symptoms of nerve strain in the interior, despite the unfavorable conditions in which it had to operate—the wild nature of the country and the scattered population. The detachment of Dejasmatch Gugsa and other minor chiefs was a further symptom, showing that the Italians were seeking to smooth the path of their strategy by fulfilling the old Roman maxim "divide and conquer."

Early in November the Italians resumed their southward advance, and on the 6th captured Makale, some eighty miles distant, again without meeting resistance. They then began to widen their penetration westward to the Takkaze River. If the Ethiopians were still showing a more than expected power to hold themselves in check, they had failed to develop real guerilla activity in harassing the advance. This was a lost opportunity, since the Italians suffered growing difficulties over the problem of supplying their forces. The scale of those forces accentuated the congestion of the inadequate communications. If the Ethiopians had been endowed with even a small air force they might at this time have precipitated an Italian disaster by attacking the narrow and scanty routes of supply on which the Italians depended. In the south, General Graziani's forces captured Gorahai on the 5th, a coup in which they effectively used the "air barrage" method to overcome the defenders before the attack was launched. But the exploitation of this advance broke down, and the pursuing forces had to fall back.

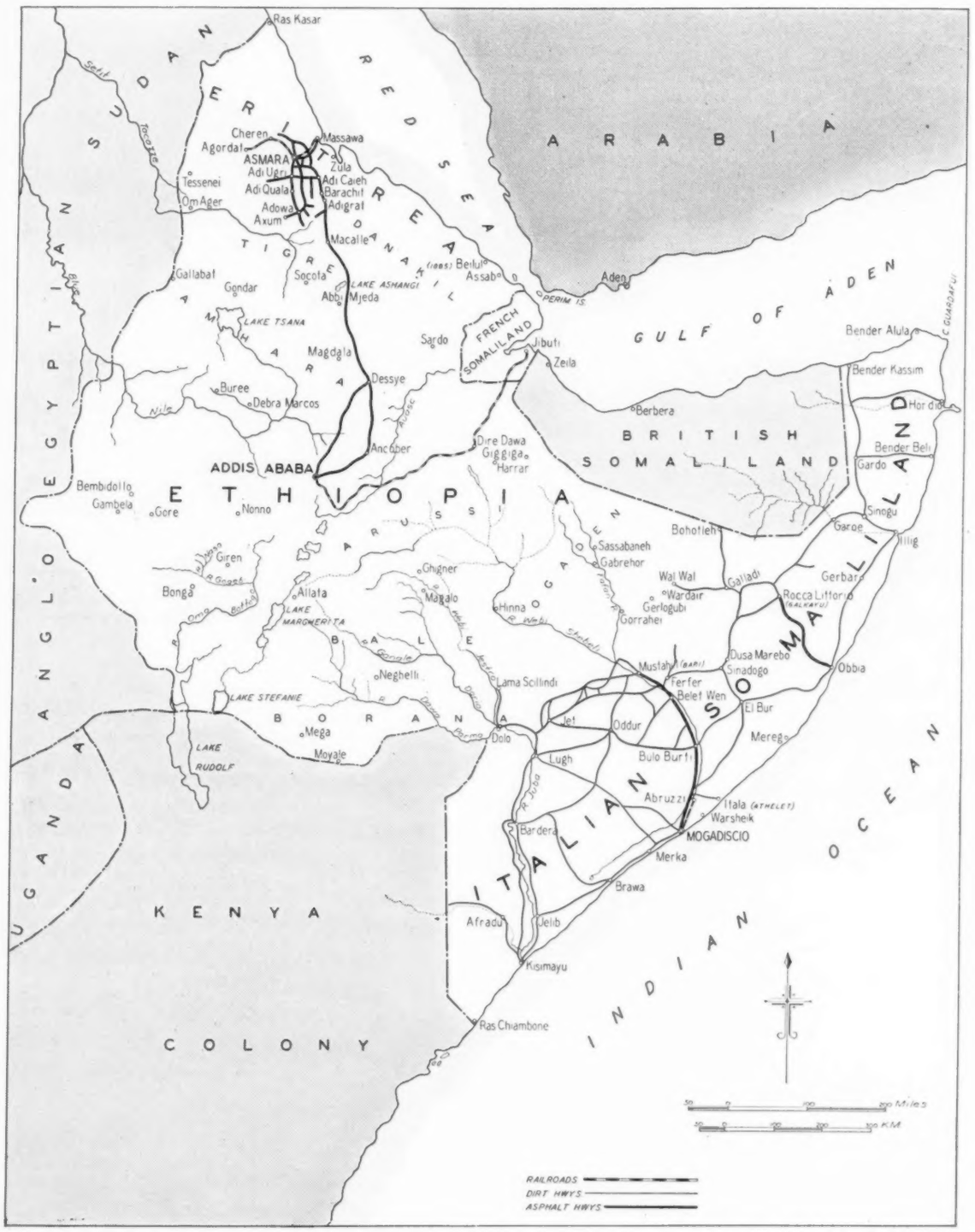
Stagnation set in everywhere, and the initiative passed to the Ethiopians, who at last began to develop a modified form of guerilla counterpressure. Circling around the Italians' far-extended flank, in mid-December—a few days after the Hoare-Laval proposals had been formulated—they regained the crossings of Takkaze by surprise and pushed some way towards Aksum. A week later Ras Seyyum recaptured part of the Tembien and thus began to threaten the Italians' hold on Makale. They have since admitted that the effect of these moves made their whole position precarious. The timely intervention of the Italian aircraft did much to curb the immediate danger, but the worrying pressure was renewed and extended.

THUS when the new year opened, the Italians' military situation was not an enviable one. Contemplation of it led a large body of opinion in Europe to count on it worsening and to overlook the permanent elements of weakness which underlay the Ethiopians' situation. There was inadequate ground for such optimism so long as the Ethiopians lacked the means necessary for an intensive guerilla campaign, and until they also demonstrated their aptitude for it.

In mid-January the campaign took an ominous turn. Emboldened by Italian passivity, Ras Desta's forces pushed forward to the Somalian border near Dolo. If this was a potential threat to the flank of the Italian line of invasion from the south, it exposed the Ethiopians to a counterstroke in an area where the terrain was favorable to tanks. General Graziani seized the opportunity, temporarily shifting his axis, and struck at the target thus offered. The tanks appeared in the Ethiopians' rear, their resistance collapsed, and the victory was followed up by a 240-mile pursuit to Neghelli. The following week the Italian forces in the north launched an offensive in the Tembien to relieve the pressure on the position at Makale. The Ethiopians met it with a counteroffensive in which partial success was purchased at heavy cost. It provided disquieting evidence of a new tendency—to make mass charges in the face of machine guns. The "memory of Adowa" was asserting itself, dangerously. The Ethiopians were blunting the edge of their own forces. Marshal Badoglio noted that after the failure of these repeated attacks the Ethiopians, "discouraged by their heavy losses, a shortage of ammunition, delay in the arrival of reënforcements and food supplies," had lapsed into a state of passivity. In consequence, he decided that he could safely take the offensive south of Makale, having now straightened out his communications.

Ras Mulugeta's forces awaited the assault and thereby exposed themselves to a concentrated artillery bombardment. After being blasted by high explosive, their position at Amba Aradam was encircled and overrun under cover of a thick fog—a fresh example of the benefit of the "attack in obscurity." By reckless counterattacks the Ethiopian leaders had merely increased their losses and sapped the confidence of the men who were thus thrown against machine guns. The Ethiopians lost some 20,000 men compared with 800 on the Italian side. Marshal Badoglio left the pursuit to his aircraft, and delivered a second stroke against the Ethiopian forces in the Tembien, followed by a third against the forces in Shire. As was inevitable, machine power overcame an ill-equipped opponent who rashly accepted battle. Through this departure from common-sense strategy the Ethiopian forces had suffered a severe shaking, which was intensified by incessant air attacks. In following up their strokes, the Italians made use of aircraft to overcome the brake of supply—the army corps on the right received its entire supplies by air in its advance to the Takkaze. By the beginning of March, the Italian forces had regained the whole wedge of territory originally occupied in early November and had extended it some twenty miles further south, to Amba Alaji. This for-

Italian East Africa



The Reserve Officer, Copyright 1937, Edmond C. Fleming

This map, compiled from the latest official publications, shows the Italian Empire of Ethiopia in its now unbroken sweep from the Red Sea to the Indian Ocean. The international boundaries which once marked the inland limits of Italy's former colonies of Eritrea and Somaliland now have been dissolved. While contours are not indicated by the cartographer, the rugged terrain in the theaters of operations referred to by Captain Liddell Hart, tested and proved the value of the mechanized forces employed by the Italian Army in advancing troops and supplies quickly over great distances.

midable position was abandoned by the Ethiopians without a fight. According to Italian accounts, air action prevented the enemy making a stand there, while Ethiopian accounts say that the position was handed over to the invaders by the arranged desertion of the Gallas and other tribes: the two accounts are not necessarily contradictory, for the causes may have been supplementary.

IN HIS attacks, Marshal Badoglio had profited by using wider tactical frontages, so that the enemy's attempted countermoves were baffled and repelled by an extended fire screen. The evidence of the enemy's discouragement also inspired him to widen his strategical front. A force from the southern corner of Eritrea advanced 120 miles across the Danakil Desert and occupied the Aussa territory; its escorting aircraft fed it with supplies besides covering it against surprise. On the extreme western wing, near the Sudan border, other forces advanced across the Setit and pushed on south, towards Gondar. This important center was captured by a motor column of 5000 men with 500 lorries, which, after a preliminary move of 150 miles through Eritrea, advanced 220 miles into enemy country in 12 days.

Even so, the Italians, in five months of war, had only covered a quarter of the way to Addis Ababa. More than three hundred miles lay ahead, filled with great obstacles of nature which had incalculable delaying power if they were defended with resolution blended with discretion. Although the ever-threatened advance on Harrar succeeded, by its mere threat, in detaining in the south a large proportion of the best-equipped Ethiopian forces, the Emperor sent considerable reënforcements north to make up the losses recently suffered, and he went up to Lake Ashangi himself to take command. Thus, when time and space factors were weighed, the chance of the Italians reaching any decisive result before the rains, turned on the questions whether they could revolutionize the situation by some new means, or whether the Ethiopians would commit fresh folly.

In March, the Italians adopted the widespread use of mustard gas, which they had shipped to Eritrea in large quantities and already had tried occasionally in earlier months. Naturally, they avoided using it in battle or laying it on their own direct line of advance where it would have been a hindrance to themselves, but there was ample scope for its effective employment in covering their flanks and communications against hostile countermoves, as well as in demoralizing the enemy's reserves and his people behind the front. The effect of this new weapon on a primitive race which had no protection was dramatic—the nerve shock being greater than the physical damage. It is worth recalling that when the Germans first introduced gas into warfare, in April 1915, the French African troops were completely demoralized, streaming away in panic. Mustard gas naturally appears to have magic proportions, since the victims may be stricken without the slightest warning, merely through traversing a belt of ground which has been sprayed with the liquid some time earlier or through touching someone else who has a splash on his clothing. Although it is a disabling rather than a lethal weapon and the deaths from it were relatively few in the European armies, the death rate may be very high with unprotected troops and where no remedial treatment is available.

The rapid decline of Ethiopian morale which followed the repulse of their massed attacks and the advent of the gas campaign made it seem hopeless to await the Italians' advance or to rely on harassing operations against their flanks and communications. The Emperor was impelled to abandon wise strategy and adopt the desperate measure of launching his forces at the end of March to the assault of the Italian position at Mai Chio, south of Amba Alaji. The result was fatal, and could hardly have been otherwise. In their repeated attacks during the day of March 31st, the Ethiopians had some 8000 men killed—more than a third of the attacking force. Next morning a fresh attack was delivered merely to cover their retreat, which soon degenerated into a rout under the pressure of the air pursuit.

THE collapse of this suicidal offensive was followed by the collapse of the Ethiopian Army's will to resist. Thus the path of advance on Addis Ababa was suddenly cleared. There were many positions on the way where a comparatively small body of determined troops with machine guns might have checked a multitude of assailants. But they were left open to the Italians, whose problem was now simplified and reduced to the organization of a triumphal march along a very rough road. This was largely a motorized march covered by a far-ranging barrage of aircraft.

On April 9th, the Italians began their advance on Dessye with the Eritrean army corps of some 18,000 men. It was fed mainly with supplies dropped by parachutes during its march of 120 miles, covered in six days. Meantime Marshal Badoglio organized a picked force of 20,000 men, half Italians, half native troops, with a large convoy of lorries, to carry out the further advance on Addis Ababa. This was brought up after the capture of Dessye, and leaving there on April 25th, it pressed forward in three columns by different routes to reach Addis Ababa on May 5th. The invasion had been begun with a mass of over 300,000 men; the decisive advance, along the final three-quarters of the distance to the enemy's capital had been carried out by a severely pruned and newly proportioned spearhead composed of 20,000 men, 1000 motor vehicles, and part of the 500 aircraft which had by now been concentrated in the war zone.

In the south, Dedjasmatch Nasibu's army still offered a stout resistance on an entrenched line south of Sassa Baneh, showing the difference which even a trifle of modern equipment could make. Successive Italian attacks were repulsed for three days, but the lock was finally forced on April 18th with the aid of air bombardment. Graziani's advance was then again held up by the mud, and Sassa Baneh was not occupied, after another stiff fight, until April 29th. With the Italians here on the offensive the disparity of loss had been less marked than in the north; their casualties had been some 2000 compared with the Ethiopians' estimated 5000. But with the flight of the Emperor, resistance had lost its point, while Nasibu's forces distintegrated under air pursuit once they were driven into the open. Thus the Italians' continued advance on Harrar was a procession delayed only by the weather.

THE machine had triumphed over the man. The Lion of Judah had been crushed between the upper and nether jaws of Italy's mechanized forces. This reflection epitomizes the course of the Abyssinian War. It is no denial of the qualities of skill and courage which were called for, and displayed, in the handling of the modern weapons with which the Italian forces were equipped. There were stout-hearted men in the ranks of the invaders and in the command posts: without

the power of resolution and endurance no deep advance into such a wild country would have been conceivable whatever the superiority of weapon power. And back in Rome there was a human dynamo, charging the battery with an electric current. Yet when the fullest credit is given, apart from the moral issues, to these human factors, we are left with the basic fact that the decisive difference was produced by the war machine.

The facts of the campaign point unmistakably to the conclusion that mechanization in the broad sense was the foundation on which the Italians' military superiority was built, while aircraft, the machine gun, and mustard gas proved the decisive agents—the machine gun on the ground for shattering the enemy's attacks, and the machine gun in the air for exploiting his recoil; mustard gas as an invisible and disheartening screen against interference and also as a spreader of panic at a distance; aircraft as a supermobile cavalry arm and as a means of giving the ground forces a mobility, through elasticity of supply, they could not have attained otherwise; also as a distributor of disintegrating propaganda. If the Ethiopians played into the enemy's hands by providing him with targets, it should also be realized that with the advent of aircraft the chance of conducting successful guerilla warfare has been much impaired, as was foreseen by that supreme exponent of the art, T. E. Lawrence. It counters the guerilla's mobility by superior mobility. Yet, as it was, by trying to fight like an army, the Ethiopians gave the air arm its opportunity to show its power in land warfare for paralyzing the action and destroying the strength of armies. It was a writing on the wall—and the more significant because it was engraved on a remote mountain wall. For here was a theater of war so rugged and so strategically inaccessible that aircraft and landcraft operated under exceptional handicaps.

The Italian command at first increased their own handicap by beginning the invasion of Abyssinia after the style of the invading hosts in 1914. By relying on mass they impeded their own mobility, so that what they gained by their mechanized means of movement was largely offset by the fact that they used them merely to feed and maintain great masses of infantry. The supply of such large forces as were employed demanded a well-developed system of roads. The building of these roads called for a great number of laborers together with troops to protect them. The task of feeding and otherwise maintaining all these involved a great increase in the transport demands and in the traffic over the new-built roads. That enormous traffic destroyed the roads almost as fast as they were built. So the difficulties were multiplied by the very means taken to overcome them.

THUS the Abyssinian War began by providing a fresh illustration, in a somewhat different form, of the lesson of the last European war—that armies are impeded more than helped by their own growth. Mere quantitative superiority of force carries its own antidote. The experience has merely confirmed the neglected warning of the famous eighteenth-century master of war, Marshal Saxe, that "multitudes serve only to perplex and embarrass." He saw, like Sherman a century later, that there is a limit, determined by mobility, to what one may call the *economic size* of an army. That is something which requires unusual art to gauge—mass and mobility are hard to reconcile. Unless the true mean can be found, force is liable to be stultified by its own forces.

It was fortunate for the Italians that there was no air force to oppose them. That missing factor was their salvation from something worse than congestion and internal disorder. At the end of 1935, after a campaign of three months, the Italian masses were at a standstill with nothing to hit, while the overburdened communications by which they were being fed provided a target for guerillas. How much worse it would have been if those narrow mountain routes had been bombed from the air. In this state of stagnation, morale was being sapped. Then the Abyssinian leaders came to the rescue of the Italian command by attempting a series of massed attacks, thus providing a target for machine guns both on the ground and from the air. In exploiting the Abyssinians' recoil, the Italians turned their infantry masses into road makers and relied for their own forward thrust on relatively small motorized spearheads. The advance of these mobile columns was covered by a long-range and flexible barrage of air bombers, while their supplies were brought up in part by air transport.

The Abyssinian War has given the military world much to reflect upon. It has shown the fallacy of the familiar argument that machines are not a substitute for men—by which is normally meant the weight of the many, not the quality of the essential minimum. It has shown, more clearly even than the World War, that mass has become a mere encumbrance, dangerous to the employer, when the attempt is made to concentrate it in the fighting line. Under the new conditions, skilled quality had a value greater than ever before, whereas the "big battalions" are becoming meaningless save as a cause of military bankruptcy.

Four Decades of Mechanization

Our Record of Combat-Vehicle Development

By Robert J. Icks*

ALTHOUGH mechanization can be considered as covering the entire field of military armament, this paper will cover only automotive vehicles designed for closing with an enemy. Many interesting types necessarily must be omitted for this reason. As it is, the field is broad and detailed.

The subject of mechanization has received so much attention during the past eight or ten years that ordinarily it is thought of as being of comparatively recent origin. At least, it is considered as a development of the World War. To a considerable extent this is true, since it is only from that time on that the possibilities of automotive fighting vehicles have been realized fully. However, the history of mechanization in the United States extends well back of the period of the World War. To be exact, it is almost coincident with the beginning of the automobile industry, and for a long time progress in this field was due almost entirely to the work of one enthusiastic pioneer who has received but little recognition. This pioneer was Maj. R. P. Davidson, Illinois National Guard, (now Colonel Davidson, Inactive Reserve) of Northwestern Military and Naval Academy.

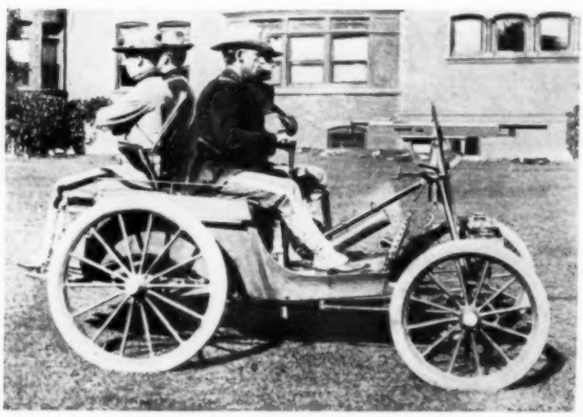


FIG. 1. THE DAVIDSON-DURYEA SEMIARMORED CAR, 1898

Several months past, a statement was made in ARMY ORDNANCE that some thirty years ago Lieut. Gen. Nelson A. Miles, then Chief of Staff, had recommended the conversion of five of our Cavalry regiments into an automobile corps. It was Colonel Davidson who had inspired General Miles' keen interest in the use of the automobile for military purposes. In 1898, Colonel Davidson designed and had constructed by the Charles E. Duryea Company of Peoria a 4-wheeled automobile mounting a Colt automatic gun with armor shield (Fig. 1). Considerable experimental work was carried on, but most of his time was taken up repairing tires, tinkering with the three-cylinder make-and-break spark-equipped gasoline engine, and replacing broken rear axles. This car probably was the first armed automobile ever built in any country. At least it antedated both the French Charron and the British Pennington armored cars by several years.

The following year he designed a car to be operated by steam and mounting a Colt automatic gun. Two cars were built in 1900 after this design in the manual-training shops of the Academy, at that time located at Highland Park, Illinois. For their day they were quite satisfactory and quite practical for general road use, but due to the fact that tubular-type boilers were used, there was some difficulty in negotiating hills because of the water level in the boilers. These cars (Fig. 2) were used in connection with cadet training and maneuvers for several years. With the coming of improvements in commercial automobiles during this period, however, the steam cars had quite outlived their usefulness. Therefore, in 1909, Colonel Davidson purchased a Cadillac chassis and mounted on it a Colt automatic gun, and in 1910, purchased two Cadillac automobiles and mounted on them Colt automatic guns in ball-and-socket bases. These latter vehicles were called "balloon destroyers"—it was the period when the balloon was receiving a great deal of attention throughout the world (Fig. 3).

The two 1910 cars were entered in the grueling 1910 Glidden Tour. They were driven from Cleveland down through the mountains of Tennessee, the swamps of Mississippi, across Texas to Dallas, and back to Chicago by way of Omaha. There were thirty-eight entries in the run. Thirty-six of them were driven by expert drivers while the Cadillac balloon destroyers were driven by cadets. Nevertheless, the two cars were among the nine cars which completed the run. Considering the roads of the period and the extent of automotive development at that time, this was one of the most severe tests in the history of the automobile industry and reflected great credit on both the automobiles and the student operators.

IN 1911 and 1912, Colonel Davidson designed another type of car. Again Cadillac chassis were used for the two cars built. A Colt automatic gun was mounted coaxially with a powerful searchlight so that the gun would fire parallel to the ray of light. Each searchlight was fitted also with a heliograph signal shutter. The cars were equipped with telescopic steel masts which could be raised forty-five feet, and from which an umbrella-type radio antenna was spread. The wireless instruments were operated by current developed from the engine, and it is interesting to note that the development of a suitable generator for this purpose was coupled with the development of the Delco starting and lighting system. These cars also had small balloons made of goldbeater's skin by means of which the antennae could be raised several hundred feet. Demonstrations were given with the cars at Washington and a number of other places, and several long cross-country trips were made.

While in New York, one of the cars was placed in the show window of the New York Cadillac Company in Columbus Circle where it attracted the attention of the consul general of Guatemala. He approached Colonel Davidson and suggested that he build two similar cars for his government but

*Author (with Jones and Rarey): "The Fighting Tanks since 1916." Captain 423rd Infantry (Light Tanks).

it was not possible for this to be done at the Academy, partly because it was in process of moving from Highland Park, Illinois, to Lake Geneva, Wisconsin. The Cadillac Motor Car Company then built the two cars which were shipped to Guatemala. Two enlisted men from the Balloon School at Fort Omaha were given leave to accompany the cars to Guatemala but later were recalled. Maj. W. C. Groom (then Lieutenant Groom), who had been associated with Colonel Davidson in the development of the cars and in the Academy, then went to Guatemala for several months as instructor. Al-

FIG. 2. DAVIDSON STEAM CARS, 1900

though he had assisted in the design of the cars and had built the wireless equipment, he was required each night and morning to remove and replace the essential parts. During the night the parts were carried to a labyrinth strong room under the watchful eye of a huge Indian general. The cars themselves were kept within the confines of the walls of the Guatemalan Military Academy. Upon his return from Guatemala, Major Groom continued as an instructor under Colonel Davidson, utilizing the school cars for instructional purposes.

In 1915 Colonel Davidson designed five different types of military cars, in each case utilizing a Cadillac chassis with eight-cylinder engine. These were as follows: (1) An armored car mounting a Colt automatic gun, built as a cross-country car with a low center of gravity (Fig. 4). This car has the distinction of being the first true armored car built in the United States; (2) A military wireless car with telescopic mast; (3) A military field hospital and ambulance equipped with litters and X-ray equipment which could be set up in a special tent beside the car; (4) A military field kitchen with an electric cooker operating from current developed by the engine; (5) A reconnaissance car equipped with various instruments, the principal feature of which consisted of a dictaphone on which could be recorded descriptions of terrain in more detail than could be transcribed on a map.

The five 1915 cars as well as the earlier cars were driven by cadets in 1915 over the Lincoln Highway from Lake Geneva to San Francisco and thence to San Diego. Daily records were kept and, at the request of the War Department, a complete detailed report was sent to Washington. From San Diego, the armored car and military field hospital car were expressed to Plattsburg, New York, at the request of Maj. Gen. Leonard Wood who at that time was in command of the Plattsburg maneuvers. The cars were used to a limited extent during the maneuvers. It is of interest to note, in passing, that four of the 1915 cars still are being used in tactical problems at the Academy under the direction of Colonel Davidson and Major Groom. It is of further interest to point out that at no time except for the interest of General Miles was there more than slight general interest concerning the possibilities of the automobile in warfare as a result of Colonel Davidson's efforts. His work was not subsidized; his interest was that of an enthusiast—only now being vindicated. As further evidence of his belief in mechanization, the Academy of which he is commandant is one of two in the United States which have 6-ton tanks for training purposes.

COLONEL DAVIDSON'S experience with lack of interest in the United States was duplicated by the experience of another American who designed a tank at a time when experimenters in England and France were just beginning to wrestle with the problem. However, his experience was with an official of a foreign government. Mr. Cleve F. Shaffer, of San Francisco, was in the tractor business in that city for a number of years before the World War and finally sold his inventor's patents to the Fageol Motors Company with whom he became associated. Fageol Motors manufactured these vehicles, which were little orchard tractors, until competition forced their discontinuance. Late in 1915 Mr. Shaffer conceived the idea of armoring these tractors and fitting them with a machine gun. The plans were offered to the German consul at San Francisco and were rejected by him without submitting them to his government because "Germany was not in need of such equipment in order to win the war." Its cheapness and the fact that it was already in production might have made possible the equipping of the German Army with thousands of these little 1-man tanks before England and France had any tanks available, and easily might have influenced the course of the war. This little tractor was on the order of the Pavesi. The "wheels" were not wheels at all but long rimless studs which gripped on steep hills, sand, and mud where even caterpillar vehicles bogged down. For road operation, an endless band fitted over the studs, thus reversing the usual process for a combination wheel-and-track vehicle.

The next American armored vehicles were built privately in the United States for the Canadian Motor Machine Gun Armored Car Corps and were used in France, but these were not connected with our service.

FIG. 3. DAVIDSON-CADILLAC SEMIARMORED CAR, 1909

A group of well-to-do New Yorkers organized the 1st Armored Motor Battery, New York National Guard, which was mustered into service on March 18, 1916. The equipment was financed privately and consisted of one Locomobile,

one White, and one Mack armored car with identical armored hulls built by Carnegie Steel; two Jeffery Quad trucks, one Locomobile staff car, and seventy-two Indian motorcycles. Most of the latter were solo type with rifles carried in saddle boots on the handlebars, but some of them were equipped with 2-wheeled trailers carrying steel shields and Colt automatic guns. This unit was used on the Mexican Border after the 1916 mobilization and took part in demonstrations after the United States entered the World War but was mustered out of service on November 7, 1917. At about the same time two Regular Army Infantry units were organized on the Mexican Border to operate armored cars and motorcycles (Fig. 5). One unit had Jeffery cars and one had White cars. The armored motorcycles were Indian of two types—one originating at Springfield Arsenal and one at the Hendee Manufacturing Company.

In 1917 and early in 1918 another White car and two King cars were rebuilt by the Ordnance Department into armored cars. They were tested at the Fort Sill School of Musketry and certain improvements were to have been made. However, the Allied Commission which had been sent to the United States pointed out that there would be little use for armored cars on the Western Front so the projects were dropped. This also was the reason for the abolition of the previously organized New York National Guard unit. However, later during the war (1918), a dummy pilot car with wooden hull and double turrets was designed and built in France as a possible type of vehicle for protection in the S. O. S., and this design was adopted as a tentative standard and considered so by the Ordnance Department as late as 1921.

It is commonly believed that the first tank built in the United States was the Holt gas-electric (Fig. 6), but there were several which preceded this vehicle. Before the United States entered the World War both the Holt Tractor Company and the C. L. Best Company began building experimental models. An early experimental tank was a mock-up built by the C. L. Best Tractor Company in San Leandro on a CLB75 standard tractor. This tank was exhibited in a demonstration near the beach at San Francisco shortly after the entry of the United States into the war, but it had been built late in 1916. One of the most interesting of these early experimental tanks

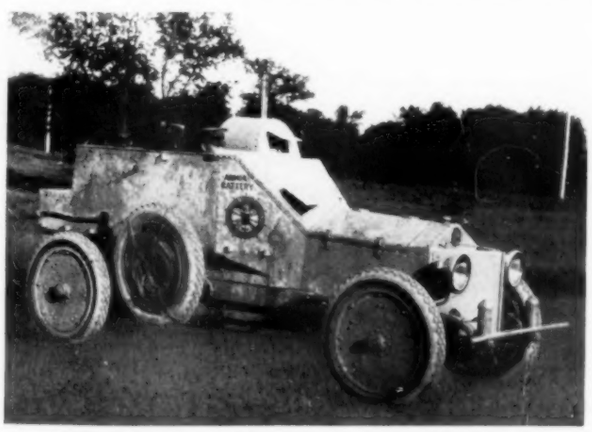


FIG. 4. DAVIDSON-CADILLAC ARMORED CAR, 1915

was the H.A.36, a 1-man tank very similar in appearance to the British heavy tanks (Fig. 7). This little tank was built under the supervision of L. H. Thoen at the Stockton plant of the Holt Company. It was powered by a motorcycle engine operating through a special transmission. The tracks were made up of Link Belt 44 chain on which were bolted wood cleats. In January 1917, work was begun at the Holt factory at Stockton on a tank designed by Messrs. Preble, Patterson, Weeks, and Wickersham. This vehicle was known as the Special 18 or "Scat the Kaiser." Later, several types of hulls were proposed for the tank and one of these was built in mock-up and a Cadillac engine substituted. With this engine the tank developed a speed of twenty miles an hour. Another armored vehicle was the G-9 built by the Holt Company at

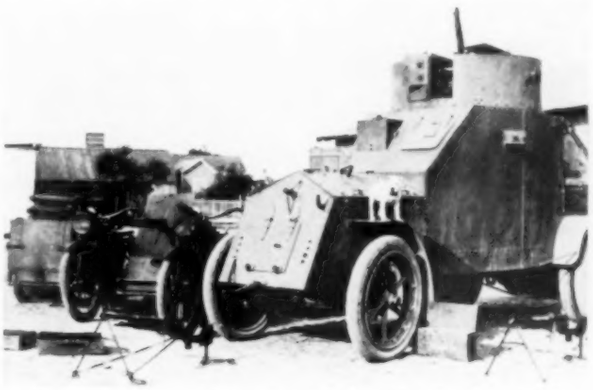


FIG. 5. ARMORED CARS ON THE MEXICAN BORDER, 1916

Peoria on a Holt 10-ton tractor. This one was tested by the Ordnance Department, which tests were observed by the Japanese military attaché.

BEFORE our entry into the war, tanks had attracted official attention, and the Military Mission in Paris had been directed to investigate the subject and to submit a report. This was done, but in the report, defects of the machines in use were stressed, and little attention was paid to principles. This report, dated May 21, 1917, was surprisingly like the first German attitude toward the value of tanks. Shortly after the arrival of General Pershing in France on June 13, 1917, several committees were formed to make a comprehensive detailed study of all phases of the use of tanks by American troops. One of the results was the recommendation that sufficient tanks of the British heavy type and the French light type be obtained to equip five heavy and twenty light battalions. A board appointed at GHQ in July 1917 recommended among other things that: The tank was an important factor to consider in the war; a heavy and a light model should be used; there should be centralized control over tank matters.

In September 1917, an order was cabled to the United States for the exact amount and kind of material needed by the tank troops to be organized, the details of the two tank designs to follow by mail. On October 14th, two officers were detailed to collect information on tanks, and it was as a result of their efforts that the treaty for the building of heavy tanks later was consummated between Great Britain, France, and the United States. Two other American officers were on duty with French tanks and completed negotiations to obtain two Renault tanks and to ship them with specifications to the United States. Several improvements were to be made, notably a bulkhead between crew and engine, the addition of a self-starter, double walls with felt lining for gasoline tanks, steel idlers in place of the wooden ones on the Renault, and a gun mount interchangeable between machine gun and 37-mm.

gun. Interest lagged again until the Battle of Cambrai in November 1917. General Rockenbach arrived in France in December, and immediately the British Mark VIII and the French Renault types formally were decided upon. It was estimated that the former tanks could be completed by October 1918, 300 tanks per month after April 1918 until a total of 1500 was reached. Cabled advices from the United States early in February 1918 were to the effect that the American-built Renaults would be delivered, 100 in April, 300 in May, and 600 monthly thereafter until the order of 1500 had been completed, plus 15 per cent monthly replacements.

General Pershing previously had ordered 600 British Mark VI tanks in September 1917, but this order was canceled later at the recommendation of Majors Alden and Drain who were the two officers assigned to study British tanks. They had reported in December 1917 that the Western Front demanded a tank of greater length and motive power and recommended the adoption of a British design called the Mark VIII, which had been designed in August 1917 for British use. This was the heavy tank to be built under the treaty previously mentioned. As plans progressed, it was seen that the committee had been overly optimistic as to production. Under the treaty signed in January 1918, the United States was to build engines, transmissions, and track parts, England was to furnish armor, track plates, cannon and machine guns, while France was to erect the assembly plant. The failure of the American aviation program prevented the diversion of Liberty engines for this purpose, and the German March offensive was so costly to the British in matériel that they could not carry out their portion of the agreement.

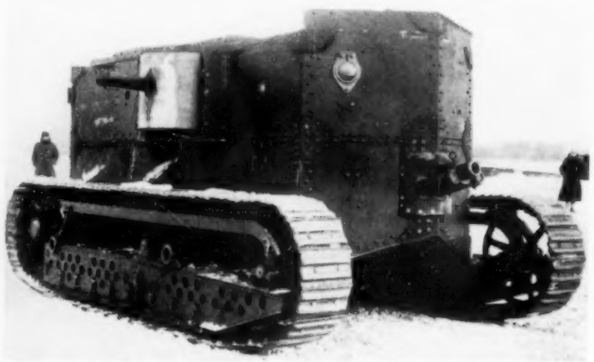


Fig. 6. The Holt Gas-Electric Tank, 1917

By June, it was evident that no useful number of light tanks could be obtained from America before 1919, so sufficient Renault tanks to equip two battalions were obtained from the French and enough Mark V Star tanks were obtained from the British for one heavy battalion. The latter were required to serve with the British in return, however. When the Tank Corps was first organized in the United States, the 1st Battalion of the 65th Engineers became the nucleus. From this, a continual expansion took place to the six battalions which reached Europe and the equivalent of eleven more in the United States. None of the latter ever saw a tank during the period of their service.

Serious unforeseen difficulties arose in the United States in connection with the metric system of measurements on the light Renault tank, but this was only part of the reason for the failure to produce the 6-Ton Special Tractors, as they were then called. Tank corps HQ in France constantly were misinformed from the United States as to the progress of production on the light tanks. Although GHQ was cabled in February 1918 that the first one hundred American-built Renaults would be in France in April, at the time the cablegram was sent there were actually only twelve people connected with tank design and production, and the drawings had not yet been completed. Captain Braine was sent from France to the United States to assist production because he was one of the two American officers who had received complete instruction in the Renault factory and at the French Tank School.

Were they not so tragic, some situations might have been amusing. At least they represent lessons for the future since they were a travesty on our vaunted superiority in large-scale production. For example, GHQ believed the first tanks almost ready for shipment to France and rushed Captain Braine over with a newer turret design so that the newer design could be ready with the tanks. Captain Braine found one turret being designed in Washington and another in Dayton, and no interest was displayed in the one which he brought. One of the home-talent designs was completed after three and a half months, found to be unsatisfactory and had to be abandoned—after which the newer French model was adopted.

In connection with the tank machine gun, the only guns available were several thousand Marlin guns which belonged to the Signal Corps. Over the protests of the only officer in this country who was familiar with tanks and who was sent here for the purpose of speeding production on them, it was decided to purchase some of these guns and have them modified for tank use at the Marlin-Rockwell plant. After they were shipped, the manufacturers delayed with one excuse after another. Then permission to ship them could not be obtained because the Ordnance Department Supply Division had not received a requisition from the Procurement Division, which had not received a purchase order from the Supply Division, which could not authorize it because the Requirements Division had planned on these guns for 1919 on authority from the Engineering Division! Another example of lack of coördination was in connection with the tank speedometer. The A.E.F. wanted this speedometer to read in kilometers, but after much argument and cabling back and forth a compromise was made to include kilometers in the odometer and miles per hour in the speed dial.

Delays occurred in connection with priority of material for tanks. One of the manufacturers did not have the steel required for axle use and could not get it because he did not have the proper priority. An officer went to the War Trade Board to obtain this priority and was informed that a priority on billets from the steel mill was necessary. The steel mill took the stand that they would have to obtain a priority to make billets. The billet mill needed a priority on coke, the coke manufacturers on railroad cars, and so on. Naturally, with a system like this it was little wonder that results were impossible, since the 6-Ton Special Tractor consisted of about 1200 parts and a total of some 33,000 pieces. The first tanks reached France on November 29, 1918. Of the 1200 light tanks which were to be completed by July 1918, approximately 10 reached France too late to be of service. When subjected to a test in France to determine the character of the armor, it

was found that it was not proof against caliber .30 armor-piercing bullets. Thereafter, each piece of armor placed on the remaining tanks built on this order was subjected to a firing test prior to its acceptance, and the 952 tanks built for the Army after the Armistice actually were proof against caliber .30 armor-piercing ammunition. Numbers of these tanks were placed in service, forming our standard light-tank equipment until recent years. Fortunately for our national defense, this chaotic condition hardly is likely to occur again, thanks to the work of the Ordnance Department and the procurement planning under the Assistant Secretary of War since 1921. Nevertheless, the waste of millions of dollars was appalling. But even this would have been excusable had some results in the shape of tanks shipped to France been achieved.

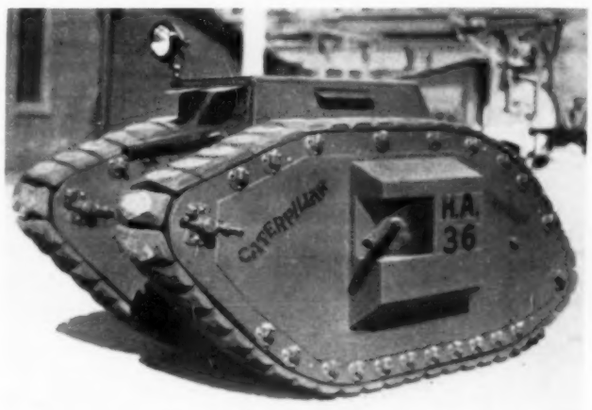


FIG. 7. THE HOLT (H. A. 36) ONE-MAN TANK, 1917

THE most unfortunate side to our war-time tank program was the lack of coördination between the arrangements made overseas and in this country. During the time the ambitious tank program previously mentioned was being arranged for in Europe by the A.E.F., other agencies in the United States were busy designing tanks for use in France. Of most serious consequence in this regard was the fact that much of the previous mechanical experience of the Allies was ignored; practically all of the designs put forth were of mediocre design mechanically and thus foredoomed to failure, and the thought and labor which would have assisted in the tank program planned by the A.E.F. was thus diverted. After April 1917, various agencies of the Government began to direct the design of these tanks. The first of them was the Holt gas-electric tank built through the collaboration of the Holt Manufacturing Company and the General Electric Company. This was a small tank—weighing some twenty-five tons due to the weight of the transmission—armed with Vickers machine guns and a Vickers 2.95-inch mountain gun (Fig. 6). Then came the steam tank.

Capt. Henry Adams designed a flame-thrower in August 1917, and as he was an Engineer officer, the construction of this was undertaken by the Engineer Corps. The demonstration of his device in November 1917 was so successful that Gen. John A. Johnson, backed by Endicott Johnson Shoe Company, and Phelan and Ratchesky, Boston bankers, decided to build a tank to carry it. A British Mark IV tank then in the United States was taken as a model. The result was the steam tank, built and demonstrated in Boston in April 1918. It was operated by steam engines, had as armament the flame-thrower and four machine guns, and weighed fifty tons. The late Colonel Miller, Ord. Res. of the faculty of M. I. T. was the designer. Later, a steam 3-wheeled tank was built by the Holt Manufacturing Company. This was a 17-ton tank, steam driven, with armament consisting of one Vickers 2.95-inch mountain gun and two machine guns.

Other tanks built were the skeleton tank produced by the Pioneer Tractor Company of Winona, Minnesota, and the small Ford tank. The former was an attempt to provide length with light weight. Many of the structural members were pieces of iron pipe with standard plumbing connections. The Ford tank was intended to make use, as far as was possible, of the production facilities of the Ford Motor Company and of the parts which went to make up Ford automobiles. The Ford Motor Company planned to build these at the rate of about one hundred a day. This tank weighed three and one-tenth tons, operated with a Ford engine for each track, and mounted one machine gun. This little vehicle was intended originally as a machine-gun or ammunition carrier to be used by the Infantry, but its appearance led to its being considered a tank. With modifications, it could have been used as a cargo carrier with 1500 pounds capacity or as a self-propelled infantry howitzer carrier. Under cabled instructions from GHQ in France shortly before the Armistice, after one had been tested there in October, 15,000 were ordered for various purposes, including use as an emergency tractor for the 75-mm. gun, but all orders were canceled after November 11th, and only 15 of these 2-man, low-slung little vehicles were completed.

The S.O.S. had requested a tank for protective purposes and a later Ford 3-man tank was designed and built. This tank weighed seven and a half tons and mounted one 37-mm. gun and one machine gun. It is also known as the Mark I tank. For experimental purposes, several of the tanks used by other nations during the war were brought to this country. These were the French Schneider and St. Chamond, the German A-7-V, and the British medium Mark A, Mark IV, Mark V, and Mark V Star tanks. They are now in the museum at the Aberdeen Proving Ground.

By the time of the signing of the Armistice more than half of the parts which were to have been built in the United States for the Mark VIII tank had been completed. Two Mark VIII tanks had been completed in England and fitted with Rolls Royce engines. These were tested in August 1918. Another machine was partly built in England and shipped to the United States, arriving here during the latter part of June 1918. The other essential parts being built in the United States were not ready and so others were custom-built at the Locomobile plant at Bridgeport after the hull arrived from England. This first tank carried the normal British armament of two 6-pounder guns and Hotchkiss machine guns. The completed tank first ran on September 29, 1918, and the first official test took place on October 31st. When the Armistice came, the War Department accepted the parts already completed. Heavy tanks had been so successful during the war that the General Staff decided that the Mark VIII program should be completed so far as possible with these parts. One hundred complete sets of the English parts were purchased, and in 1919, one hundred heavy tanks were built at Rock Island Arsenal, the work being completed in 1920. Browning machine guns were substituted for the Hotchkiss guns in these tanks. The Mark VIII tanks cost $85,000 each, which included machinery and overhead. Had the entire

program been completed the actual cost probably would not have exceeded $35,000 each.

The first of the postwar tanks was the Christie (Fig. 8). It was planned originally as a dual-purpose chassis—truck and tank. However, in order to get quick delivery and early test, considerable in the way of concessions in decreased engine power, clearance, and accessibility of parts was made. Mr. Christie, as is well known, was an automobile racing driver years before and had developed numerous advances in the automotive field, among which was the first front-wheel-drive automobile. The concessions made in the Christie design were for the purpose of attempting to meet the Caliber Board specifications for a medium tank. During the war, considerable difficulty had been experienced in quickly concentrating tanks in any particular sector for a sudden attack. Rail transportation was not always available for the heavy tanks, and special trucks could not always be obtained for the light tanks. The combination of wheels and tracks in the Christie type was felt to be of decided advantage in meeting this problem. However, the first Christie had minor defects of manufacture and hasty assembly, the engine and transmission were inaccessible, there was practically no springing, and the tracks were badly designed. On the other hand, it possessed one feature never before or after achieved, it could operate forward or backward at equal speeds.

FIG. 8. THE FIRST CHRISTIE TANK, 1919

THE Caliber Board was organized shortly after the war to lay down desirable policies in armament from our experience in the World War. The idea of this board in connection with tanks was to develop one tank—a medium—which would replace both the 6-ton and the Mark VIII types, combining in one the necessary characteristics of both. This was doomed to failure, because it is seldom possible to combine weapons of opposed or widely divergent characteristics. The War Department however, approved the medium-tank project, fixed the weight at fifteen tons and gave priority to the work of development. Specifications of the Caliber Board for a medium tank were met in part by the Ordnance Department in the medium A built in 1921 (Fig. 9), a good tank which had maneuverability, satisfactory armament, and a speed of ten miles per hour, but it was a specialized weapon. The original specifications required that the tank had to be able to cross a 9-foot trench, which meant a tank over twenty-one feet in length and also meant that two could not be loaded on one flat car—a waste of transportation space in the congested area of operations. The armor specifications provided for protection against caliber .50 armor-piercing projectiles. As a result, the actual weight of the tank grew from fifteen to twenty-three and a half tons. After it was completed, a new pontoon bridge supporting not over fifteen tons was adopted, and it was planned to build another smaller medium tank to come within this maximum.

The medium A was, therefore, considered unsatisfactory, and although the Christie could be tuned up to give a beautiful flash demonstration, it too was unsatisfactory. The

FIG. 9. THE MEDIUM A TANK, 1921, CROSSING A PONTOON BRIDGE

Front Drive Motor Company rebuilt the 1919 Christie into the M1921 Christie, a tank which performed so well at first that the Tables of Organization were modified on the basis of eventual rearmament with these tanks. Mr. Christie then produced in 1921 his first amphibious tank, which could run on wheels, on tracks, or in water. Sometimes considered to be the first amphibious tank in the world it actually was second in this to the British medium D series. The following year the Christie amphibious tank was rebuilt and gave a remarkable demonstration in December 1922 in crossing the Hudson River at New York City. Further refinements were made, and the tank again was rebuilt in 1923. The Marine Corps observed the operation of this model but did not adopt it. It never was tested officially by our Government.

The Ordnance Department designed and built the 1922 medium tank, incorporating features from the medium A and adopting certain features from a British tank, the medium D. This British tank had been designed near the close of the World War for use in the German rear areas had the war gone on into 1919. It also was a good "flash" vehicle. Two features which we borrowed from this design were the flexible tracks with cable suspension and the track frames higher in rear than in front. Like the medium A, however, this tank was not the tank wanted by the Army. It was not as good a tank as the medium A.

In endeavoring to develop specifications for a divisional tank, the War Department laid down certain requirements about this time. The French had been testing the Kegresse track on their Renault tanks and had used tanks so equipped more or less successfully in the Riff campaigns in Morocco. The Ordnance Department arranged the purchase of a complete track assembly and an extra track from Andre Citroën in France, intending to make such an installation on one of our 6-ton tanks. This was found to be impossible because of differences due to the metric system, and the change was made instead on an old Renault tank at Aberdeen under the direction of a French engineer and his mechanic. After completion in August 1925, the tank was tested. There was an increase in speed from five and a half to ten miles per hour and a considerable decrease in the noise of operation, but the low track mileage life and other defects led to our abandoning this project. During the same year, another medium tank, the T-1, was built at Rock Island Arsenal, very similar in appearance to the medium A. It was a considerable improvement on the two previous medium tanks but retained their major faults.

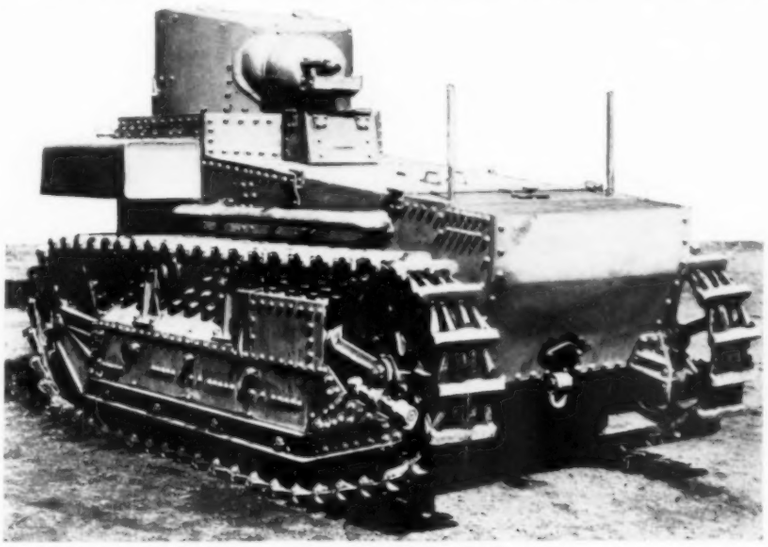


FIG. 10. THE LIGHT TANK T1-E1, 1927

INTEREST in light tanks for infantry use revived in 1926. The Chief of Infantry received authority and submitted specifications for a light tank in January 1927. A fast, well-armed, dependable tank which could be carried on a commercial 5-ton truck was aimed at. The Ordnance Department

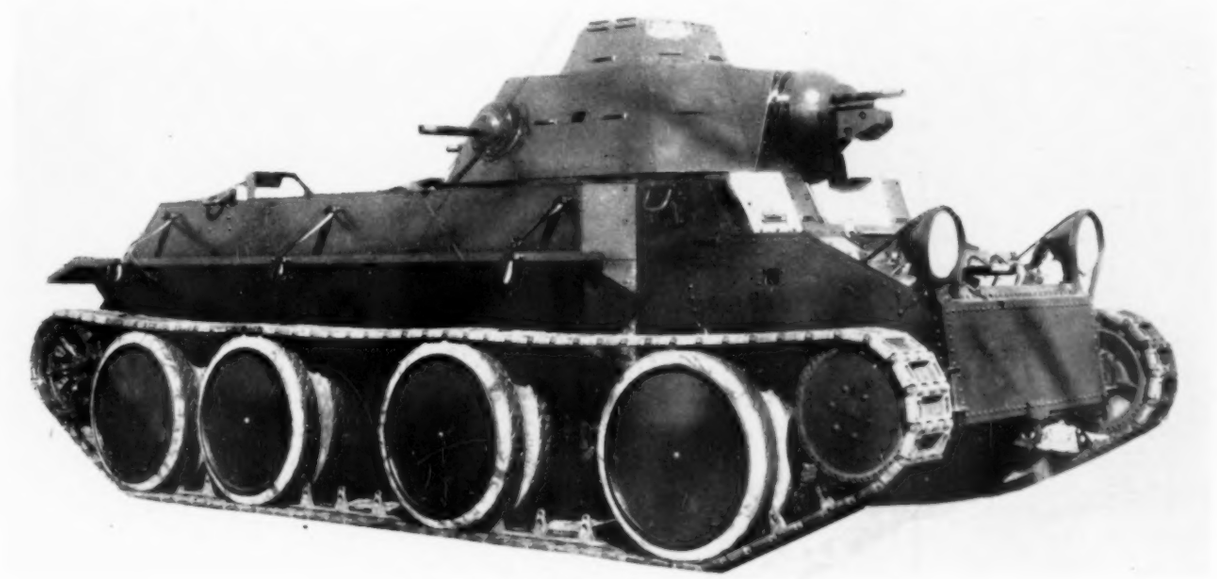


FIG. 11. THE MEDIUM TANK T3-E2, 1933

collaborated with the Society of Automotive Engineers and drew up the designs which incorporated the latest automotive improvements, including a new type of springless suspension, known as the link type, in which shocks were intended to be equalized. Another feature was to build the chassis as an all-purpose one, reducing the difficulties of war-time procurement. Thus the tank chassis would serve also as a chassis for gun carriers, cargo carriers, etc. The first of this series of light tanks was the T-1 built by James Cunningham Sons and Company at Rochester, New York. The armament in these tanks was one 37-mm. cannon in a combination mount with a caliber .30 machine gun built to Ordnance Department drawings and specifications. The pilot model was demonstrated at Rochester in October 1927, and the changes required were incorporated in the succeeding model, the T1-E1 or Type 1 Experimental Model 1 (Fig. 10), which appeared in 1928. The Cunningham people also built in this year an experimental 1-man tank on Ordnance design. The British military press, beginning in 1925, had been featuring the 1-man tank idea because of the preliminary success of the Martel and Carden Loyd tankettes. Our 1-man tank was built partly to test such a design in this country but mainly to test a special type of flexible track which would be available in war time through modification of commercial band-saw steel.

Fig. 12. The Light Tank T1-E4, 1932

The first scout car built after the war was the partially armored Pontiac or light T-1. This was really a reconnaissance car with bucket seats, carrying only an armored shield in place of the normal windshield. It had a crew of four and carried one machine gun beside the driver and a second one in the rear on an antiaircraft mount. This car was followed by the completely armored T-2 cars built on La Salle chassis. They had boxlike hulls with no turrets and were used principally on the Mexican Border. Each had a crew of four and carried one Thompson gun and one machine gun. The latter could be elevated above the level of the roof. Until this time the Cavalry had been interested mainly in armored cars for reconnaissance purposes, but there became apparent an interest in tanks. The 6-ton tanks provided in the Tables of Organization for the Cavalry division were far too slow to accompany rapid cavalry action. After the organization of the original Experimental Mechanized Force at Fort Meade, Md., for about three months during the summer of 1928, much more interest became apparent. This original mechanized force was organized for the purpose of formulating doctrine and determining the desirable types of automotive equipment. The British Mechanized Brigade had been publicized widely and the military press throughout the world emphasized the importance of this variation in warfare.

Mr. Christie had reorganized his company into the U. S. Wheel Tracklayer Corporation, and had designed a new tank which continued his basic idea of a convertible wheel-and-track tank. So extraordinary were the results achieved in the first tests in October 1928, that not only did military mechanization enthusiasts in this country advocate immediate adoption of this tank, but representatives of other nations made arrangements for purchase, as well. Five Christie tanks were ordered by the War Department.

In the meantime, the Ordnance Department in 1929 modified the T-2 La Salle armored cars by rebuilding the hulls in various forms and adding turrets of various kinds. A further model in the T1 light-tank series also was built during this year—the T1-E2. Minor defects in the T1-E1 were corrected but the major defects (*e.g.* engine in front of driver, rough riding and center of gravity too far back) were left uncorrected, the armor was thickened, and the engine horsepower increased. The light tanks of the World War period were intended for strategical transport on trucks because their life on tracks was short. The stamina shown by the T-1 light-tank series gave an indication that it might be possible to eliminate trucks as tank carriers with a resultant simplification of organization and supply. Since then, the goal has been to eliminate the use of trucks and to develop light tanks which are possessed of sufficient stamina and speed to possess their own strategical mobility. The Christie tanks first proved that this effect might be achieved. In 1930 one of the T1-E1 light tanks was modified by the Ordnance Department into the T1-E3 to provide a better suspension system than the link type used in the T-1 light-tank series. Rollers, bogies, and vertical coil springs within hydraulic shock absorbers formed the suspension change and materially improved the riding qualities.

ALL during this period, there had been differences of opinion between the using services and the designing service, or between the Infantry and Cavalry and the Ordnance Department. One of the principal grievances of the Infantry was the fact that in tanks of Ordnance design the engine was placed in front of the driver where heat and fumes were blown back; moreover, dead space for vision was too great. The Quartermaster Corps also took a hand in matters, and there was designed and built at the Holabird Quartermaster Depot near Baltimore an armored car on a special chassis and utilizing the Franklin air-cooled engine. While this was an excellent vehicle, its chief claim to fame lies in the fact that it was intended to be interchangeable with a truck body, thus simplifying war-time procurement. This armored car later became known as the T-7. The Holabird Depot also built some small armored cars on commercial Whippet, Plymouth, and Chevrolet chassis on the design of Col. Bruce Palmer of the Cavalry School. They were very similar in type, but each had certain features not possessed by the others. At the Cavalry School some experimentation was taking place with

motorcycles armed with Thompson submachine guns. The first real armored car, however, was the T-4, Ordnance-designed and built by Cunningham. This is a 6-wheeled car in which the armored hull forms the framework, there being no chassis as such.

In 1930, through the efforts of Capt. George H. Rarey, instructor in charge of the light-tank section of the Tank School, arrangements were made to install a Franklin engine in a 6-ton tank, to modify the idlers because of the increased speed which would result, and to reduce the noise existent in operating these tanks. The water-cooling system in our light tanks, as well as in our heavy tanks, never had been satisfactory, and the Franklin engine gave promise of permitting a modification likely to prove practical in modernizing our existing light-tank equipment. The results justified the experiment, since the speed of the tank increased to ten miles per hour and the noise was reduced by at least fifty per cent. Due to the showing made by this modification, the War Department decided to modify six additional 6-ton tanks for the use of the Mechanized Force, which was our second experimental mechanized group, organized at Fort Eustis, Virginia, in 1930. The work was done at Fort Meade by the Ordnance shops and the tanks were delivered for use. A later Franklin engine was used, and other modifications were made in the cooling baffles. After delivery of the six tanks, the first one also was modified accordingly. These tanks were known as the 6-ton tank A-1. This development was later discontinued due to a decision of the Chief of Infantry to cease improvements to war-time tanks.

Although the three earlier medium tanks had failed to meet specifications, they continued in experimental use, but there came a definite change in viewpoint regarding the use of break-through, penetration, or leading tanks. It was decided that this type had an extremely limited sphere of usefulness, and that this sphere was largely imaginary and peculiar to Europe. The limitation of portable military bridges to fifteen tons as mentioned previously, led to the development of a 15-ton medium tank known as the T-2 medium, first demonstrated in 1930. It was equipped with a Liberty engine and armed with a 3-pounder semiautomatic gun in a combination mount with a caliber .50 machine gun. The secondary armament consisted of a 37-mm. semiautomatic gun in a combination mount with a caliber .30 machine gun. The weapons were poorly mounted and the gunners interfered with one another in serving them. Theoretically, it had the greatest fire power of any of our tanks built up to that time. Actually, however, the secondary armament was practically valueless. Later, when the tank was rebuilt, it was eliminated.

Ventilation had been troublesome in some of our tanks, but this tank went to the opposite extreme. The intake was inside the crew compartment, and air was drawn in at such a terrific rate that the churning by the tracks of sandy or other loose soil produced a veritable sand blast on the inside for the crew. It rode very roughly and was not well received by the Infantry.

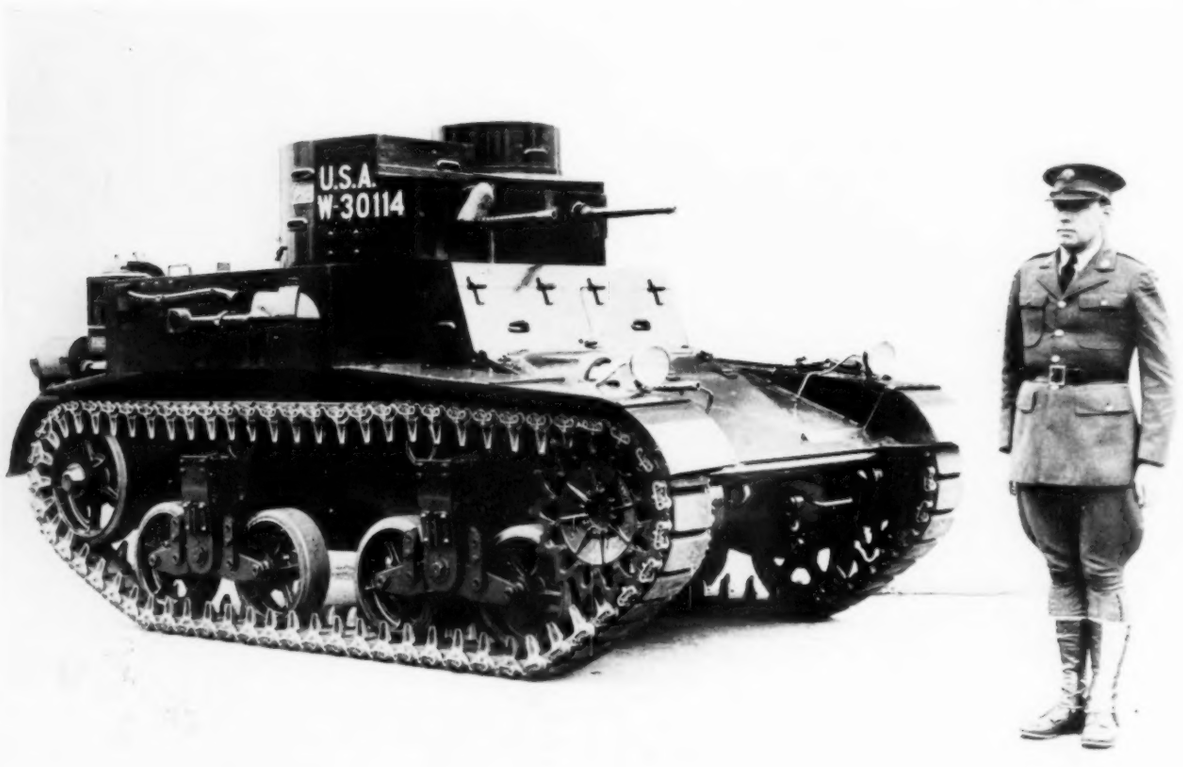
General Douglas McArthur became Chief of Staff in November 1930, and almost immediately mechanization in our service received an impetus. It was the General who visualized the use of tanks by cavalry in supporting the unchanged cavalry mission, and it was then the term "combat car" was coined to designate a cavalry tank as distinguished from an infantry tank.

The Ordnance Department arranged with Vickers Armstrongs Ltd., of London, England, for a 30-day demonstration and test of the Vickers Armstrongs 6-ton "A" tank. This tank was, in general, similar in size and armament to the light tank T1-E3 and was intended to give valuable comparison data as to the relative merits of the two designs. The test was made in the summer of 1931 at Fort Meade, Md., and at the Aberdeen Proving Ground. It showed the superiority of the British tank over any light tank built in this country up to that time. Later, one of the T1-E1 light tanks was converted into the T1-E4 (Fig. 12). This tank reversed the hull so that the engine was in the rear, a feature which the Infantry had insisted upon, and rightly so. However, it failed to stand up under the strenuous tests provided for it, although it was a definite step in the direction of a suitable infantry tank. The medium T-1 tank was modified in 1931 by installing a Liberty engine in place of the special Packard engine used previously. With this change its designation changed to medium T1-E1. By lowering compression, the power of this engine was reduced forty-three horsepower, from 338 to 295 horsepower. The change decreased effectiveness.

FIG. 13. THE CHRISTIE T-3 MEDIUM TANK, 1931

Early in 1932 the Heat Controlled Motor Company of Minneapolis presented a proposal for applying their air-cooling system to the water-cooled Liberty engine for use in tanks. The Tank School at Fort Meade aided in obtaining a used Liberty engine for the experiment, and Capt. George H. Rarey, then instructor in charge of the Mark VIII tank course, was designated to represent the Tank School in this development. The project was completed and the air-cooled Liberty engine was turned over to the Aberdeen Proving Ground for test. After being tested in August 1932 in a Mark VIII tank, the report approved air cooling in principle and this modification in particular. However, during that year, the Mark VIII tanks of the World War period were pronounced obsolete and were placed in war storage because of the expense of operating them and their slow speed.

The contract for the Christie tanks previously mentioned was let in June 1931, and delivery of the first one was in



THE LIGHT TANK IN CURRENT USE IN THE ARMY

September of the same year. These tanks, as delivered, were provided with simulated armor. The armament and engines were furnished by the Ordnance Department. The cost of each tank delivered (without armor, engines, guns or radios) was $34,500. The Mechanized Force at Fort Eustis, Virginia, was disbanded in 1932. Part of its personnel and equipment became the nucleus for a mechanized cavalry unit called The Detachment, 1st Cavalry (Mechanized) which was organized in July 1932 at Fort Knox, Kentucky. Later, this became the 1st Cavalry (Mechanized), the forerunner of a two-regiment mechanized cavalry brigade. The setting up of this organization and its purpose is indicated in the instructions issued by the War Department at the time: "The mechanization of one regiment is the first step in determining the application of modern machines to cavalry missions in war . . . without, however, altering the accepted fundamental missions of that arm." With the delivery of the Christie tanks, some of which went to the Infantry and some to the Cavalry, different designations were used. In the Infantry they were called T-3 medium tanks (Fig. 13), whereas in the Cavalry the chain-driven models were called T-1 combat cars and the gear-driven model was called the T-3 combat car.

Another of the T1-E1 tanks was rebuilt at Aberdeen Proving Ground in 1932. The principal change was the installation of the Cletrac controlled differential which permitted the transmission of power to both tracks at all times. This modification became known as the T1-E5. In 1933 the T1-E4 light tank also was rebuilt. A La France engine of 240 horsepower replaced the previous 150 horsepower engine, the hull was raised, and ventilation improved, but it was not satisfactory. It was tail-heavy, among other faults. Collaboration between the Infantry and the Ordnance Department resulted in specifications for new medium tanks of the Christie type. Mr. Christie had not furnished blueprints of the original T-3 medium tanks whose parts were found to be not interchangeable, and it was necessary to measure the vehicles and make adjustments in order to make drawings. Then the new drawings and specifications were prepared and bids were requested. The contract for several of these was let to the lowest bidders—American La France and Foamite Company. Delivery was made in 1933 of these tanks known as the T3-E2 mediums. Armament in the tanks was based on the combined used of caliber .30 machine guns and 37-mm. guns. After delivery of the T3-E2 mediums (Fig. 11), the previous medium tanks and the T-1 light series were declared obsolete and placed in the Ordnance museum.

During the latter part of 1934, a special test on cooling the 6-ton tanks was made at Fort Benning. Later the Ethyl Gas Corporation collaborated in furnishing certain equipment for use in the Buda engine to raise the compression ratio from 4 to 1 to 5.2 to 1. The result was an increase in power. The tank was successfully cooled at last, but shortly after this, all the 6-ton tanks were placed in war storage.

All of the above deals with the vehicles in which the Army is or has been interested primarily. However, several of the firms which have built these vehicles for the Army now have produced commercial designs. The vehicles produced in recent years in this country in Ordnance Department design unquestionably are superior to their previous models but we have come over a long, difficult and devious road to achieve this result. However, the using services and the manufacturing services each are giving their best efforts toward solution of the many difficult problems connected with the procurement of satisfactory types of these very important combat vehicles.

The English Recruiting Problem

Difficulties of Enlisting Private Soldiers of the Line

By Hilaire Belloc*

GREAT BRITAIN is vexed at the present moment with a recruiting problem not only different from that set to any other country in Europe, but particularly difficult of solution: it is the problem of finding sufficient recruits for Regiments of the Line.

The difficulties which have arisen in connection with recruiting for the English Line are part and parcel of all that group of anxieties which have come upon the country from the changes in modern armament, also, in some degree, from the changes in modern international relations, and even from recent changes in the internal social structure of England.

Let it be noted at the outset that the problem concerns only infantry and such cavalry as may still survive under modern conditions. It does not apply to mechanized troops, to the Navy, or to any of the bodies auxiliary to the naval arm. It does not apply to tanks, and it only applies to the Air Force in a degree later to be discussed. But it does apply to the rank and file, to the units which formed the great bulk of the old armies and which must still form the mass even of a modern English army. (I use the word, "English," perhaps too often for American readers, but my excuse must be that the new-fangled word, "British," which has now become so common among us, was not familiar to my youth save in special phrases. People of my generation think of the nation as England. "Britain" we hold to be a vulgarism, and we use the national adjective "English" in connection with our activities—save before a few words such as "Empire" Fleet.)

The elements of the situation are as follows: First, the English Government has to administer in part, and still more, to defend great areas of territory and vast numbers of human beings. The degree in which this function is administrative and the degree in which it is coercive may be neglected for the purposes of the present examination. It is all one whether we are in India with the enthusiastic support of all the Indian population or whether we are detested by it; but no one can deny that, seeing the divisions between classes, races, and interests in that vast dependency and the necessity of administration and defense, a garrison not less than the existing garrison must be found; and this is true in a lesser degree of the other very numerous dependencies of the Crown. We have to garrison each of these, many of which are obviously vital and any one of which, even the least-considered, may suddenly become of vital moment to us. This necessity for finding garrisons on a large scale outside the country is the first element in the problem; but war might involve the use of troops to defend the independent Dominions as well.

The second element is the fact that these dependency garrisons are widely dispersed. Their dispersal is of the very essence of the situation.

We have here what so often arises in the history of states and of men: that which was once their strength becomes their weakness. When the Navy was invincible, unique, and faced by no hostile arm which any rival could seriously contemplate opposing to us, it was a first and obvious principle in the commercial expansion of England to seize upon and develop insular areas—meaning by the word, "insular," not literally surrounded by water but inaccessible to invasion save by water. India was indeed accessible to land invasion from the northwest; but, though we were nervous about that vulnerable line, its vulnerability was greatly exaggerated. Those who are old enough to remember the Herat incident will now admit that the panic of the moment was absurd. The Russian Empire could never effectively have moved against the northwestern frontier. Every other district which England acquired in the second expansion of her dependencies following upon the Napoleonic wars, thus was safeguarded by the omnipotence of her fleet. Some of these territories became small, but growing, independent nations. They are called today the Dominions. They were occasionally of value to England as a recruiting ground in time of war, but permanently as a source of revenue from the interest on credits advanced to them by the Bank of England and its dependent banking system in the city of London; indirectly by the interest on credits which naturally rose between an English metropolis and mixed, but mainly English-speaking, colonies. For instance, Australasia is at this moment paying us at least twenty-five dollars a head yearly—every man, woman, and infant—as interest, let alone profits on commercial ventures of English capital.

BUT much the most valuable territory occupied during the second expansion of England—the great nineteenth-century expansion after the fall of Napoleon—was the directly dependent area with its subject populations, and of this India was, of course, immensely the most important section: it was in importance much more than nine-tenths of the whole. (To India, Burma, and Ceylon could properly be applied that much abused term, "Empire.") What is more, upon the holding of India depended that vigorous trade with the far Asiatic East of which England was for long almost the monopolist, and the only gate to which, Singapore, was solidly in English hands. Of the work to be done by the English rank and file, the occupation of India is far the most important, and will, of course, continue, no matter what tentative changes are made in the forms of Indian administration.

But these dependencies are scattered as widely as it is possible for them to be scattered. They are in every latitude and climate of the globe, with vast distances separating one from the other: islands lost in the ocean—yet having their value as places of call and links in a chain; harbors which are relays of the trade routes and on the communications of the armed marine; the great block of the Indian subcontinent; the separated Dominions which, though independent nations, would necessarily demand our aid as we demand theirs; the Suez Canal; Palestine with its precarious land frontier (the first vulnerable land frontier we have ever ventured upon)—all these form between them a congeries of which formerly the fleet made a strategical unity. But this is no longer such.

*Author: "Napoleon," "Richlieu," "Wolsey," "Cranmer," "James II," "Joan of Arc," "Danton," "Marie Antoinette," "Robespierre," "History of England," "Miniatures of French History," "History of the Great War," and many other historical studies, essays, etc. London, England.

The third element in the problem is the existence, not only of a tradition and habit, but of a tradition and habit largely *necessary;* and this tradition demands long-service *professional* soldiers.

That element is true, of course, only of the English service as it is: long-service professional soldiers are not necessary for the work the modern army as such may have to do. But such an army has been produced by two clearly marked factors in the past—first, the aristocratic system of government and, secondly, the necessity for long service overseas. Our aristocratic system of government directly provided gentlemen to form long-service officers (with the exception of the Guards, where a large proportion of officers reënter civil life after a brief experience of soldiering), while, indirectly, it made for a mercenary, professional army capable of long service—and long service, when it can be obtained, is always an advantage when one does not need the great numbers provided by a short-service, rotative system with its building up of huge reserves.

The reason that a mercenary rank and file fits in with the aristocratic social system is appreciated with difficulty in countries of a different social structure. Where aristocratic government prevails, as it still mainly does in England after two and a half centuries of continuous exercise, there is, of necessity, a sort of tacit bargain struck between the masses of the governed and those few who govern them. The governed say (or think, or at any rate, mean): "Take my land and subject me to your rule—but on condition that you let me alone." That is why freedom in the ordinary domestic sense of the term, individual freedom of habit and speech and avocations, is bound up with the aristocratic spirit in a state. Compulsory service is not only repugnant to the citizens of an aristocratic state, but would be, if it were long practiced, destructive of class government. It would give men a sense of equality which the soul of an aristocratic state instinctively abhors.

THE fourth element in the situation is closely bound up with this last. It is as follows: the cadres of the English Army have been by tradition and still are drawn from a governing class, and its immediate dependents. As I have said, the English officer, save during the brief and quite exceptional episode of the Great War, was and is of the gentry, and the English noncommissioned officer conformed closely for generations—and still largely does—to the social type of those who immediately serve the gentry. Every one who knows England must have noticed how the first-rate man to choose for any job of management or work immediately under and in connection with the governing class is an ex-noncommissioned officer. You may find that type everywhere, in the stewardships of clubs, in the higher personal service of country gentlemen, in respectable lesser-salaried positions of all kinds where the leading places are reserved for the governing class.

In other words, the cadres of the British Army naturally correspond to the organization of English society, the only society left in the white world which is still essentially aristocratic, suffering and enjoying all the evils and all the benefits of class government. The characteristics of such government are a fascinating theme, but to digress upon them here would be irrelevant. Let it be enough to say that it is of all forms of government the rarest, the most long-lived, and, in the opinion of those to whom it is unsuited, the most spiritually contemptible. It has, in the past, accompanied commercial maritime power—the great examples of it before modern England being Venice and Cadiz.

The fifth element in the situation is the traditional social position of the private soldier of the rank and file. He has been for generations, and still is, recruited in the main from the poorest classes in the community. His dangerous, monotonous, and burdensome trade is one in which the artisan with a regular craft or employment will not engage. It is the last resort even for the agricultural proletariat who, in England, earn such miserable wages—the lowest of all. You would not think so to read our literature, especially that false, semi-romantic modern stuff which repeats to weariness the word, "Empire"; you would not think it to hear men talking of the national armament in the abstract; but it is a fact that, in the general speech of the mass of the people, the trade of soldiering below the commissioned and noncommissioned ranks is despised. A man who voluntarily enters such service is thought by his fellows among the proletariat to be of the lowest sort even among themselves.

Now, consider these five elements and set them side by side with the military necessities of modern England. Those necessities still include everything that was covered by the first four points we have noticed. England must still have garrisons numerous and widely separated, although by far the most important of garrisons must still be the force which is the chief military element in the subcontinent of India. For the purposes of such garrisoning, the numbers voluntarily available would be sufficient so far as the technical arms and the cadres were concerned. For the technical arms you can always find recruitment, at least if you pay them as artisans and craftsmen. There is no difficulty in getting the numbers required for the tanks, for instance. But when it comes to the rank and file, the fifth element is affected by a recent profound change in our society. The mercenary army of very ill-paid rank and file formerly depended for its economic existence upon a certain submerged margin of the proletariat, from the youngest of which, in their extreme need, recruits could be obtained. That extreme need has disappeared. English society, the most capitalist of the world and therefore the most proletarian, was reorganized under recent acute peril of dissolution through the discontent of the wage earners. These last, when lacking employment, are today kept alive on public funds administered by the officials of the community; and this new factor in our social system has utterly changed the spirit of what is called "the labor market."

THE funds available for the destitute man and his children are quite insufficient for decent living; but the mere fact that such a refuge now exists, however insufficient, has caused the proletarian in England to lose what had been the motive force of his actions. It is true that there was always *some* provision for the completely destitute. Under the old Poor Law a man could, indeed, be kept alive, but the conditions of his succor were made as ignominious and cruel as possible. He never regarded himself as shielded from destitution if he refused to accept a wage offered him. Today, the whole proletariat regards itself as secure, in peril of grave insufficiency but not of complete destitution; and this new conception lying at the back of the mind has altered the mentality of the populace altogether. To the funds which secure the unemployed proletariat one must add new pensions for widows, new insurance against accidents and illness, new paying by the state of pensions to those who have no other source

of income or revenue and have reached the age of sixty-five.

Now, in such an atmosphere, it is becoming difficult and may soon be impossible to obtain the private soldier of the Line under the old conditions. That is the first aspect of the problem now facing English recruitment. It is parallel to the problem facing domestic life in the middle class through the inability of getting sufficient domestic service.

It has been suggested (and the suggestion will probably be acted upon) that this particular, and somewhat narrow, aspect of the problem may be met by much higher pay and better living conditions during the period of service. But even if these be granted, there will remain the prospect of unemployment upon discharge and the virtual ban upon an early marriage, in a class where early marriage is not only the rule but a kind of necessity.

It is difficult to see how, even if the Army were maintained at its present low strength, the numbers of the Line could be maintained on a basis of voluntary recruitment without completely recasting the conditions of military life. And such a recasting of them would be most expensive, for it would have to include not only much higher pay but married quarters, family allowances, largely increased cost of transport, and—most difficult and expensive of all—some scheme for insuring civilian employment after discharge.

But there lies behind all this a much graver difficulty than finance. Can England remain content with so limited an armed force by land? It is the declared policy of the moment so to remain. But will not the competition of rivals and the mere sequence of events prove too strong for that policy? Once hostilities begin, they may, and commonly must, lead either to occupation of territory or to heavily increased defensive action to maintain territory already occupied; nor can any great European nation today practice isolation for any indefinite period and as a fixed principle of policy. Faced by the threat of major hostility in any form, England will certainly need for the moment forces increased many fold. How shall these be found under the present system? They cannot be improvised even as to numbers; as to organization and staffs, it is obvious that all such must be permanent or worthless.

What then is to be done? A solution upon the following lines suggests itself: A dual force which consists of two elements standing side by side. The first element would be a professional army such as England already has, capable of somewhat limited expansion by reserves. Such an army would include, of course, all the technical arms as well as the rank and file of the Line. The second element would be, side by side with this, a militia, the units of which should have sufficient instruction to be ready material for incorporation and further training. This militia would have ready to hand all reserve material and—what must be essential—permanent formed and trained staffs with a reserve of cadres to be called upon at short notice. Under such a scheme, the technical arms—artillery of every kind, tanks, the Air Force, etc.—would form a very much larger proportion of the standing army than they ever have done in the past. One could not in their case depend upon expansion after the opening of hostilities or even during the mere approach thereof. The scheme, therefore, even as it stands, would be exceedingly expensive and bring the country still nearer to that limit (*now well in sight*) beyond which not even the powers of the chief banking nation of the world can push its economic effort. It would be a scheme, novel as well as burdensome, and to be set going only at the cost of considerable social friction. An obvious alternative would be conscription and the consequent simplifying of the whole problem into one military arrangement corresponding to the numbers of the community. But conscription in time of peace would seem, for the present at least, intolerable to the mass of the population and therefore inapplicable. The whole country rises to meet a visible national danger, but a contingent danger is not manifest to it. What measure of quite short service of a militia type would be accepted? Only experiment can show, and that after some considerable preparation of opinion; but it generally will be admitted by those who know modern England that the difficulties of attaining even so highly modified a form of general service will be very great.

That is the kernel of the problem. That is the crux of which every man in England acquainted with the international situation is anxiously aware. We cannot in the long run do without the potential, at least, of a large armed force for use by land. At the same time we cannot be confident of receiving sufficient popular support in the formation of such a force. And there for the moment the matter rests.

Standards for Army Supplies

The Peace-Time Simplification of War Requirements

By George V. McPike*

THE responsibilities of the Assistant Secretary of War, as set forth in Section 5a of the National Defense Act are concerned primarily with the question of *what* to procure for the Army of the United States.

The final decision as to the adoption of a type or the classification of an item as standard or substitute standard is a command function and therefore rests with the General Staff; prior to such adoption or classification, however, it is necessary for the developing arm or service to clear the item through the Office of the Assistant Secretary of War for assurance that it is adapted to mass production in time of emergency.

To the majority, the word "standard" implies something carefully established by man, as a compulsory unit of weight, measure, or coinage; for example, commercial standards represent specific limitations below or beyond which the grade, quality, composition, or dimensions of a commodity shall not be allowed to fall. However, the term has a broader significance, including as it does *voluntary* standards set up by common consent or as a result of the natural processes of evolution. N. F. Harriman in his recent book "Standards and Standardization" says:

"It is evident that the mere legal fixing and enforcement of fundamental and secondary units and standards through an indispensable prerequisite of industrial standardization does not of itself tend to reduce the variety of types, grades, sizes, finishes, etc., of products in use, nor does the *legal fixing* of standard requirements of purity and quality have more than an indirect effect in this direction. . . . It is because of (voluntary) standardization of industry that western civilization has been able to forge ahead and eastern civilization remains pretty much where it was one or two centuries ago. . . .

"No one can doubt that the standardization of materials, machines, processes, and products of manufacture has been one of the prime aids of American progress in the industrial arts. When a standard gage of track, standard couplers, air brakes, etc., were adopted for all railways, the unification of all the lines on the continent into a single system of transportation by the interchange of cars was made practically possible. Think what it would mean if each individual railway had its own gage of track, so that no cars or locomotives but its own could run upon its rails. Think what it would mean if each make of automobile required its own peculiar tires and spark plugs. The efficiency of these great inventions would be so minimized as to be all but destroyed. In standardization the same principle has been applied with equal advantage to a thousand other things, great and small."

A PHASE of standardization is simplification, which has been defined as that policy of management which has as its object the conduct of all activities and the performance of all functions of an enterprise in the least elaborate manner consistent with any given purpose. Our essential application of this policy consists in reducing excessive variety of types and sizes of products purchased or sold. Simplified practice is a method of eliminating superfluous variety through the voluntary action of an industrial or commercial group. While standardization is primarily technical and creative, simplification is commercial and selective; its function is to determine which sizes or items of a product are most important and to concentrate production on them wherever possible. Commercial standardization and simplification, insofar as the Government is concerned, are represented by the activities of the Trade Standards Division, Bureau of Standards of the Department of Commerce and the Division of Simplified Practice thereof. Any industrial group or individual company may request the coöperation of the Bureau of Standards in the establishment of a commercial standard.

National standardization is conducted under the auspices of the American Standards Association. Founded in 1918 by five technical societies—the American Society of Civil Engineers, the American Institute of Mining Engineers, the American Society of Mechanical Engineers, the American Institute of Electrical Engineers, and the American Society for Testing Materials—the membership has increased to 37 member bodies including 9 engineering societies, 21 trade associations, and 7 departments of the Federal Government. The Association itself does not initiate standards; but any responsible body may initiate proposal for a standard. The basic principles of procedure provide for consideration by broadly representative technical committees, and it is assured when the standard is recommended that it has the extensive approval necessary to make it an "American Standard" in the broadest sense of the word.

Organized standardization in the industrial life of the United States is of comparatively recent origin. In 1917, the War Industries Board was formed as a very important part of the Council of National Defense. To the Conservation Section of this Board was allotted the task of conservation of matériel needed for war purposes. By a system of priorities it worked out a program for the operation of industrial plants on a balanced basis. It controlled the awarding of contracts, the allotment of raw materials, power, and labor. Industries producing nonessentials and luxuries were discouraged; essential industries were encouraged. Its economies through standardization and simplification were very great. It saved 50,000,000 yards of wool, 260,000 tons of tin plate; cut the styles of stoves and heaters 75 per cent; eliminated 5500 styles in rubber footwear; cut tire varieties from 287 to 32; cut shoe colors from 81 to 6; cut trunks to 6 sizes; cut varieties of pocket knives from 300 to 45; and saved 600,000 barrels of flour by improving bread-marketing methods. One great and lasting effect of the war-time efforts toward standardization was the interest created in such work and the undeniable proof of the advantages and possibilities of standardization when put on a national basis.

The present Standards Division, Office of the Assistant Sec-

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retary of War, traces its descent from the Conservation Section of the War Industries Board. In 1919, the War Industries Board passed out of existence; its records, however, were kept in the custody of the Council of National Defense until 1920 when Amendment 5a of the National Defense Act was passed charging the Assistant Secretary of War with additional functions. At this time the records were transferred to the War Department.

THE Standardization and Specifications Division is the technical coördinating agency of the Director of Procurement, within the War Department. It is charged with clearance of type as to question of procurement; clearance of specifications; coördination of War Department activities on standardization, simplified practice, specifications with other Federal agencies and with national engineering and technical societies.

As applied to the military service, the term "standardization" is more inclusive than the term as applied to industry and commerce. It includes not only the decision as to what is the most advanced and satisfactory type, but applies also to the procedure of adoption by the numerous agencies that are involved. Army Regulation 850-25 sets forth the requirements in the procedure of development substantially as follows:

When the military necessity for an item is determined, the using arm or service, through its technical committee, prepares a statement of the military characteristics as desired and forwards the requirement to the Secretary of War for consideration by the General Staff. If it is approved, no material changes or departures can be made from the characteristics as set forth without specific authority. The chief of the supply arm or service charged with the development of the item then institutes a development program; designs are prepared and preparations are made for the manufacture or purchase of a pilot or model from experimental funds. The item is classed as a required development type, and experimental test is made to determine the technical suitability of the article and to eliminate obvious defects and flaws. If the experimental test is satisfactory, then the item is changed to service test status and request is made for authority to purchase a limited quantity for service test by the using arm. The object of the service test is to determine its suitability for tactical requirements. If favorable, then the item is recommended for standardization by the using arm and procuring branch and cleared for procurement through the Office of the Assistant Secretary of War as to questions of procurement arising in connection therewith.

The chief of the supply arm or service is required by regulation to consider throughout all stages of the development work that adaptability of the items to *quantity production in emergency* be considered as one of the most important requirements of design, and this naturally implies a thorough investigation of production facilities. It is the duty of the Assistant Secretary of War to see that these responsibilities have been fulfilled.

Heretofore, procurement planning has been delayed because of the reluctance in so many cases of the using arm to recommend an article for standardization. There is always present the natural tendency to await perfection. To remedy this unsatisfactory state of affairs, Army Regulations were recently changed to provide that whenever the processes of standardization cover a long period of time, the Assistant Secretary of War may upon application by the chief of the supply arm or service, authorize him to initiate procurement planning for the item considered by him most suitable and available for the purpose, and the Adjutant General, upon request, will furnish the chief of the supply arm or service with a tentative basis of issue for procurement-planning purposes.

PRIOR to 1926, supervision as to the preparation of specifications and final clearance thereof was regarded as a function of the General Staff. In 1927 this function was taken over by the Assistant Secretary of War. At the same time the Assistant Secretary was charged with the function of contact with the Federal Specifications Board, the American Engineering Standards Committee (now the A.S.A.), the Division of Simplified Practice, and supervision of commercial standardization activities of the supply branches of the Army.

After the item has been adopted as standard, preparation of a specification is in order. Army Regulations define a specification as "a clear and accurate description of a material, an article, or a service which it is necessary to procure, and the procedure which the purchaser will follow to satisfy himself that the requirements of the specification have been complied with." A description of the item is not only required but also the process of inspection which will give assurance of protection to the interests of the Government. "The responsibility for the preparation of a specification rests primarily with the supply arm or service principally interested in the development or having a paramount interest in the supply of the article or material." The Assistant Secretary of War is charged with the supervision of activities concerning the preparation of the specification and the progress of the work. That part of the technical staff of the supply arms and services charged with the function prepares the specification, and after coördination with all arms or services which may be interested, it is presented to the Assistant Secretary for procurement clearance. Clearance involves a check for the following features:

1. Has the item been adopted by proper authority? It is required that an article should have been adopted as standard or substitute standard before clearance for procurement in a U. S. Army specification. Exceptions are in the case of motor vehicles and articles which through long years of usage in the service have been accorded an unofficial status as standard and accepted as such.

2. Is the form, numbering and arrangement as prescribed? To provide for uniformity and to insure that no essential elements are omitted, a standard form is prescribed by Army Regulation 850-25. Reference to subsidiary specifications should be confined to those cases where the materials, components, or processes are required in the *quality* and *detail* which the referred-to specifications are designed to produce. Otherwise, the requirements should be covered by original statements in the body of the specification.

3. Is it a clear and understandable description of what is to be procured? A complete workable specification should contain the information needed by all those who necessarily must use it in obtaining the material desired. It should be a synthesis of the knowledge and experience of both the purchaser and the producer in order that there may be a meeting of the minds of the parties. The use of ambiguous, equivocal, or vague words and phrases should be avoided.

For example, the use of such terms as "heavy-duty shaft" and "approved alloy" is prolific of disputes and delays. What is a "heavy-duty shaft"? What are its dimensions? What may be considered a "heavy-duty shaft" today may be regarded otherwise tomorrow. What constitutes an "approved alloy"? Who approves it, and how does he test it?

4. Are other interested arms and services in accord with the contents of the specification? Coördination is a long and tedious process, and too often the tendency is to assume that an arm or service has no interest in the proposed article, especially when the arm or service preparing the specification is the sole procuring agency. Whenever it is reasonable to assume that an arm or service *may* be interested, coördination should be effected.

5. Are requirements reasonable and in accordance with good engineering and manufacturing practice? Ordinarily this should be shown by the statements of manufacturers who have been consulted.

6. Is the specification restrictive in any of its terms? Although proprietary articles and commercial products made by processes under the control of the manufacturer cannot, from the nature of the case, be made the subject of a specification, the tendency in many cases is to specify the article by name with the phrase "or equal." The burden of proof that the item or material used is the equal of the trade-named article or material called for is thus placed on the contractor. In many instances this would involve lengthy tests; inspectors do not ordinarily have facilities for determining the relative merits of items and the usual result is that the contractor finds it easier and safer to put in the trade-named article. This is, perhaps, a subtle method of securing exactly what the purchaser has in mind, but it is hardly to be commended as a means to secure quantity production in an emergency, while the opportunities for favoritism that it presents alone should condemn it. A similar objection arises when fabrication according to a model is prescribed. In this case definite knowledge of what is in the model belongs only to the particular manufacturer concerned. Duplication requires a most exact and minute examination, and in many cases such would be impracticable. Tests for equality with the model may involve considerable expense and time, which perhaps would be prohibitive under the circumstances. The result of such restrictions usually is to deprive the Government of the benefit of free competition, resulting in higher prices, delays, and uncertainty as to the satisfactory performance of the article contracted for.

In addition to the U. S. Army specifications, there are in use by the Army about 1050 Federal specifications. Regulations approved by the President April 12, 1935, provide for the preparation of specifications by the Federal Specifications Section, Procurement Division, Branch of Supply, Treasury Department. These specifications shall be binding upon and govern all executive departments. However, when an executive department finds, for administrative reasons, that a Federal specification cannot be used to meet its particular or essential needs, it may use its own purchase specification; but this shall include all applicable provisions of the Federal specification, and in case where the purchase exceeds $1000, a report shall be made to the Procurement Division, Branch of Supply, showing the necessity for the deviation.

Strictly military items will not be considered for Federal specifications. There are 74 technical committees and many subcommittees working on Federal specifications. The War Department is represented on 68 of these committees by 48 different individuals. It is the duty of the Standards Division to represent the War Department on the Federal Specifications Executive Committee; contact and coöperation is maintained with the Department of Commerce, National Bureau of Standards, Division of Trade Standards and Simplified Practice in the establishment of trade standards and elimination of waste in industry. The War Department is a member of the American Standards Association, being represented on 40 of the technical committees by 33 representatives.

Viewing the picture in its entirety, it is believed that War Department standardization is proceeding in accordance with rational and progressive principles. In conclusion, I would like to call attention to an extract from the annual report of the Chief of Staff for last year:

"I have been convinced for some time that the lack of standardization of equipment of every variety in the Army is a distinct detriment to procurement as well as performance, and that standardization is an essential not only for efficiency but to counteract the mounting cost of production. In past years there has been too much of a tendency to delay adoption of an item pending further test and improvement. There is no question that this procedure has resulted in a delay in the procurement of essential items urgently required for the training of troops, especially in new doctrine and tactics. This is particularly true in the procurement of airplanes, tanks, motor vehicles, and automatic rifles. I believe that we can standardize our equipment, purchase the best that is available at the time, and change the standards annually, if necessary, as improvements or defects develop. With this in view, action has been initiated to apply this principle throughout the service. Excellent results are anticipated.

"In a national emergency there will be an urgent need for the immediate and uninterrupted flow of munitions to the troops. To insure this involves industrial preparedness. To this end the War Department must keep up to date at all times accurate estimates of the items necessary for our forces at various stages of the mobilization. Our great industrial activities must be kept informed of specifications and details in order that they may plan to produce the munitions required. I regard this as one of the most important phases of our scheme of national defense. Without the supplies necessary for our forces, trained personnel, however numerous, will be of little avail in time of conflict."

Editor's Note: This is the second of a series of articles on the governmental agencies functioning in connection with the Office of the Assistant Secretary of War for the peace-time development of plans and policies of industrial mobilization. The first article of the series, "Army and Navy Munitions Board", by Col. H. W. T. Eglin, was published in the March-April issue of this journal. These studies are designed to acquaint readers with the trends of policies enunciated in the Industrial Mobilization Plan, revised 1936. The plan is a public document. It can be procured from the office of the Superintendent of Documents, Washington, D. C., at fifteen cents a copy. It embodies the latest thought on industrial mobilization planning in the United States, and while it is by no means intended to be a dogmatic rule of industrial mobilization in any future war, it propounds the best thought on the subject at this time. Its study is recommended to all.

Training The Reserve

Primary Emphasis Must Be on the Technique of Weapons

By Melvin M. Johnson, Jr.*

IN VIEW of the recent congressional appropriation for additional Reserve-officer training, and in view of the inevitable reliance of our nation upon a trained Reserve, the writer feels justified in setting forth a brief analysis of peace-time training methods which might improve the efficiency of our forces. To clarify the discussion, this analysis will be conducted in the form of leading questions as follows:

What is the ultimate objective sought in training Reservists?

We seek to prepare qualified civilians, as thoroughly as public funds will permit, to perform their duties with the utmost efficiency immediately upon the outbreak of war. We must recognize the complexities of modern war and war machinery. We appreciate the wide application of numerous civilian pursuits to the needs of national defense, such as the construction and production of automobiles, engines, canned goods, clothing, chemical products, radios, steel work, etc., and we seek to utilize civilians thus engaged by adapting them, their factories, and machines, to war requirements. Thus, through our Ordnance Department, we may establish a highly efficient Reserve organization which shall become the backbone of procurement and the service of supply in an emergency. Facilities for the immediate production of vast quantities of supplies and matériel, operated and administered by skilled Reservists, will prove a vital factor in our national defense. Our troops must have proper and adequate equipment without fail. Training methods for the Ordnance Reserve are obvious and well established.

The materials thus produced are of no avail unless troops of the Line thoroughly understand their operation and the technique of their employment. For this phase of war, our officers are primarily responsible. They must be fitted to teach their men in the art, and to direct them as well in the field. In a word, our Reserve officers must know how to handle and employ their weapons and their men.

Experience is inevitably the best teacher. However, we must face the fact that it is impossible to reproduce actual war conditions in peace time. We do not have and cannot have even a substantial part of our initial forces mobilized, and the expense of attempting to do so is not only objectionable but entirely prohibitive from the taxpayers' standpoint. Many authorities maintain that our objective is not attained unless we engage in numerous large-scale combat problems. These may be possible at times for the Regular and National Guard units, but not so for the Reserve. Moreover, the situation with respect to war is not analogous to the practice of scrimmaging football teams. Actual war conditions hardly can be simulated. The argument that we should confine ourselves to trial wars between the inevitable Reds and Blues recalls the story of the man who was challenged to drink fifty mugs of ale on a wager. He excused himself, but returned, full of confidence, and accepted the wager on the ground that he had just drank fifty mugs so he knew he could do it!

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What important phases of the art of war may be studied economically in the training camp and in the classroom?

We already have disposed of the phase of supply and procurement. With respect to the armed branches of our service, it is obvious that we may study the operation of the weapons of war and the technique of employing those weapons. Moreover, there are certain fundamental principles of combat which never can be avoided and which never must be violated. We may study profitably the principles of war, their theoretical application to future problems which we anticipate, and their actual application, proper or improper, in historical situations. For example, recognition of the necessity of providing for security under all conditions should become a Reserve officer's "habit of thought," and that habit can be acquired by an adequate study of military science.

It is apparent that the Reservist, therefore, can readily study textbooks, solve map problems, learn tables of fire, study the art of directing fire by indirect laying, and take appropriate extension courses, especially those relating to combat, employment of weapons, principles of tactics, map reading, etc. All of these studies are absolutely essential, and can be done at home by the fireside, or discussed around the table, or delivered in a lecture hall. They are now available.

IT IS submitted, however, that every Reservist subject to intensive, active field training should be given a large proportion of range work. Not only should he fire the rifle, pistol, and automatic rifle; he should be familiar, at least, with the actual firing of the submachine gun, the machine gun, the mortar, the 1-pounder, the pack howitzer, the 75-mm. Each officer ought to operate and direct the fire of all those weapons. He ought to understand from actual firing the effective ranges, limitations on accuracy, methods of adjustment, and types of fire of each of those weapons. Moreover, he should actually attend a course of instruction at a gas school. It is not meant that he should stand around a gun while the instructor talks and then watch one or two of his fellow students pull a lanyard. He should perform each operation, especially that of directing fire, not once but many times. He should be given special instruction on exterior ballistics both in class and on the range. For as long a period as possible he ought to eat and sleep and live with as many weapons as he possibly may be called on to use or direct. We have and can provide facilities for such training.

In view of the importance of antiaircraft weapons, the officer must be given plenty of firing experience with the available arms. He should be informed and afforded an opportunity to consider new types of arms about to be introduced. In this way his interest and curiosity can be aroused to the end that he will give the subject considerable, independent thought. Thus, after the close of a training period, whether it be two weeks or one year, the Reservists will still be giving time and thought to military science.

Is there actual justification for the argument that Reservists should receive, primarily, an education in weapons when on active duty?

WE HAVE already indicated some of the reasons for this contention that the technique of employing weapons and their operation is the most practical, economical, and valuable phase of peace-time training. The reader is well aware that many officers in the regular service are woefully ignorant of their weapons. For example, officers are called upon to establish positions for their weapons in combat within effective ranges of their targets and yet to place the gun crews in protected positions as far as possible. Therefore officers in rifle and machine-gun units should understand and distinguish the boat-tail and flat-base bullets used in rifle and machine-gun ammunition. This is elementary. It is a fact that many do not know anything about the boat-tail bullet. The answer is that officers in the regular service have so much routine and "fatigue" duty, paper detail, etc., that they have no time to study many subjects which bear on warfare. Let us strive to avoid that situation wtih the Reserve officer who is to be trained for nothing but warfare.

An amusing case in point occurred back in 1928 or thereabouts. A certain field officer, on an examination map problem, was directed to place his machine guns so as to bring their fire on certain distant enemy targets without exposing the crews to howitzer platoon weapons of the opposing enemy battalion. This officer examined his map and found an excellent position some 2500 yards from his targets. There the mortar was out of range, the 1-pounder defiladed, and even reasonable protection was afforded from artillery fire. In choosing that position this officer ignored a less-protected site about 1200 yards from the targets. The hard-hearted examiners severely criticized his solution on the ground that the chosen site was beyond the effective range of his weapons. But the officer was an old hand. He suddenly remembered that somewhere he had heard of the new Mark I ammunition which was already being distributed to the service. He recalled that this ammunition had an extreme range of 5500 yards against 3300 yards for the earlier flat-base issue upon which the examiners relied. These observations he respectfully submitted to the examiners, stating gently that he had assumed the examiners were familiar with this new ammunition and naturally supposed they would expect him to use it; that the boat-tail bullet increased the effective range of the .30 Browning at least 1000 yards. The examiners are still wondering if they should give the officer credit for solving the problem or for doing some very fast thinking under pressure.

We have already decided that weapons are becoming more and more important in warfare. Obviously, officers must be thoroughly familiar with their tools and must understand the nature and kind of fire which the enemy in turn is likely to direct under a variety of circumstances. The leader of a unit is directing and controlling weapons rather than men in modern war. Of course the human equation is present, but fire power is virtually the omnipotent element. It is not a case of placing your men, so much as bringing to bear the fire of your weapons. The student of military history will assure you that weapons have repeatedly changed tactics. Consider the machine gun in this connection.

In time of peace we can afford to expend ammunition and weapons for practice; not so in war. When the average man has stomach trouble, he goes for an operation to a doctor who has studied that organ. It is the man who thoroughly understands how to use his tools and how to make them fulfill his requirements who is the real military expert. Granted your officer must have many other qualities; granted those other qualities are of great importance; nevertheless, the officer must know with what kind of materials he is dealing. The average American still thinks that all he has to do when war is declared is to take down his trusty gun from the wall, do a little close-order drill with the boys, and go to the front. He has never been defeated in any war, and he thinks he never will be. Why? Well, just because!

If we do not learn as much as possible about weapons in peace-time, when shall we have the opportunity? Surely, not after mobilization day. Then there is too little time to study weapons. We may not have allies to keep the ball rolling for six months or more while we are being educated. But in any event, we can learn to handle men after M-day. There will be plenty of opportunity then and only then. It is submitted that the average soldier is far more willing to follow leaders who manifestly understand the technique of employing their weapons than to follow leaders who are ignorant of or confused by the complexities of a machine gun; who innocently lead their men into shrapnel fire by close columns of platoons; who order frontal attacks on machine-gun nests; who place their 1-pounders in deep ravines and their mortars on hill tops; who order shrapnel fire on dugouts and high explosive on troops advancing in extended order; who launch mustard gas against prevailing winds just prior to a general advance. Any soldier can detect the uneducated officer in short order. If the officer really knows his weapons, he has at least acquired a firm foundation on which to build up his professional knowledge, and the man never lived who could not learn something. Often soldiers are not going to see their officers in battle. Officers will not wave a sword and lead close-order regiments with muskets at high port in frontal marches on embattled opponents also armed with muzzle-loaders. In the next war men will "sense" the control of their leader; they will sense the effectiveness of his work; they will trust and respect him because he knows, and they know he knows, what he is doing. Modern weapons, we repeat, are technical. They require calm, undisturbed, and prolonged study. It is true that they may change from time to time. That however, is no excuse for not learning about those in current use. Otherwise, we should train in peace time with a ballista instead of a 75-mm.; with a bow instead of a rifle. Our Navy should sail the CONSTITUTION instead of the IDAHO.

WHAT are the arguments against placing primary training emphasis on the technique of weapons?

The strongest argument is this: weapons are only one factor in war. There are many other factors. No officer is fit for war who has not been trained, for example, to lead men, to execute elaborate troop movements, to maintain order and discipline in the unit, to handle and control large bodies of men under field conditions, to solve combat problems in actual or simulated combat.

We are considering the problem of training men to fight. We have precious little time at our disposal. Reserve officers must earn a living. They are civilians. They have to have plenty of patriotic enthusiasm to devote their spare time to military pursuits. Most of them, it is submitted, are more interested in weapons than in any other phase of warfare.

Many officers in the regular service often complain because they want more duty with troops. Much emphasis is placed on experience in handling troops. That is a very important factor and must be given grave consideration. However, just

what do we mean when we say "handling troops"? In modern war those troops are really weapons, are they not? Look at the tables of organization of a war-strength company. In the Marine Corps rifle company there are over one hundred rifles, twelve light Brownings, twelve grenade dischargers, and about twelve Thompsons. Is it not quite important to understand the employment of those weapons in combat? It is hardly necessary to call attention to the weapons of the machine-gun and howitzer company. In the last war many company officers knew far less about their weapons than the men they led. All hands learned how to dig a trench and how to march and stand at attention. But many never even fired a rifle until they reached the front, and then they began taking part in an attempted war of movement, still clinging to the familiar close-order system. (See *Encyclopædia Britannica,* 14th edition: "Infantry.") That was a ghastly mistake; that was the cost of war. Read over the Infantry Mailing List for the past six or seven years. Disease and ignorance of weapons have been the most effective allies of death in every war. Yet as Hegel said: "We learn from history that we do not learn from history."

The reader is urged to study the Boer War in this connection. Authorities speak of situations where eighteen or twenty Boer riflemen held up a British battalion. Why? They knew how to get the most out of their Mausers. Braddock's men were highly disciplined, but they did not know the Indian technique of employing weapons. Most of them were slaughtered. Yet it is probable those men and their officers had drilled more than any army of their time. We still use that same close-order drill system. It is important. It is a factor. But it can be very much overdone. There is much else to learn and there are only twenty-four hours in one day.

WHY should we not continue to place primary training emphasis on discipline and exercise of command derived from close-order drill?

The reader is undoubtedly familiar with the system of volley fire used by the infantry in the late eighteenth century. Whole armies faced each other at close range. The front rank fired in exact unison. The rear rank loaded. The men stood shoulder to shoulder. A large amount of intestinal fortitude was required to stand up and take those ponderous slugs on the shiny belt buckle. Gaps in the ranks were immediately filled. In general, those men were given so much close-order drill that they obeyed the commands under fire from pure instinct. They learned to load their pieces in the same manner. That was their method of building up fire power. Incidentally, few of those soldiers could read or write.

In the late nineteenth century and in the early days of the World War thousands were slaughtered because they were still subjected to that system, modern repeating breechloaders to the contrary notwithstanding. Soldiers were still cheap. The theory obtained even in those recent periods of conflict that if an army kept on closing up the gaps and coming on, the morale of the enemy would be broken. Unfortunately, the average machine gunner had an entirely different reaction. There is nothing that can make a machine gunner as happy as a target which is dense, either physically or mentally.

It is submitted that the shattering of the enemy's morale is a vital factor. But which is the more effective: a display of fireworks or the infliction of a high percentage of casualties from weapons which are operated with a deadly regularity and paralyzing effect? A German officer wrote in his memoirs that nothing in the war so shattered the morale of his troops as an occasion when a small number of Marines directed accurate rifle fire on advancing infantry at a range of 800 yards. The air was not shattered with deafening explosions; when bullets cracked men fell and did not rise.

The men who fired those rifles had received plenty of drilling—on a rifle range. In battle their officers gave them the range and the men fired at will. They set their sights accurately. When the troops came closer the slides were lowered scientifically. Shortly after battle sights were used, the advance stopped, broke, and fell back. That engagement was won by two factors: weapons and men trained to use them. Of course they were disciplined, but the discipline they used that day was the result of many days on the range. When ordered to load, they loaded. When ordered to fire, they fired. When ordered to cease firing, they did so. Moreover, when they faced the acid test they had confidence in their individual and collective ability to get the most efficient and accurate fire from their weapons. *In the last analysis, close-order drill is simply a means to an end. It should not be confused with the end we seek.* Men should be taught to respond to all commands, and officers should be taught to give those commands. In 1775 the British infantry, for example, were given close order because they actually used close order on the firing line. To them it was the end sought. Today and tomorrow, it is submitted, we should correlate the means used to attain coördination and discipline with the end we are seeking, so far as possible.

Let us consider battery A of the such-and-such Field Artillery Reserve. This battery is thoroughly schooled in parade drill. They turn out in A-1 shape every holiday. They wear beautiful dress uniforms. They march down the avenue as one man. They have won many cups in drill competitions.

Battery B, on the other hand, never wear dress uniforms. They are clean and neat, however. They have trained especially on the service of the piece. Every man in the outfit is a qualified gunner, and knows the duties of each member of the crew besides his own, from the captain down. This battery has drilled extensively in the gun park, and on the range they can fire at the rate of one round every five seconds. They hope to become more proficient with additional practice. The officers have made a special study at home of indirect fire. Last year on the range battery B won a prize for accuracy and efficiency. They hit more targets with less rounds than any outfit in the area. However, they received a very low rating on dismounted drill and very little better on mounted drill, although their marching efficiency on the road was very high. One evening, after they had completed a forced march, they were reprimanded for their lack of neatness in dress and person. But the reprimand was withdrawn when it was found that the men had been attending to their horses rather than themselves.

The men of both batteries are highly disciplined. They obey commands promptly. Battery A looks better at dress parades. Battery B hits more targets. Both batteries are excellently drilled, A battery for parades, *B battery for war.* Drilling, it is repeated, is simply a means to an end. The end or objective which those batteries must seek is fighting efficiency. Drilling with the weapons and equipment used for fighting is the means by which the objective can be obtained. Drilling for the mere sake of drilling does not even begin to approach the objective, namely, fighting efficiency.

Please do not consider this as a digression. We are discussing methods of training our Reserve for war. It is submitted that the amount of time to be given to close-order drill, that is to say, pure drill for drill's sake, should be materially reduced. Methods should and can be devised whereby we can combine the element of disciplinary drill with those drills which directly relate to the employment and operation of weapons in combat. We have many such drills now. Thus, the artilleryman drills on the service of the piece. Insofar, however, as close-order drill may be used in the movement of troops in the theater of operations, it is a justifiable drill because it is the means of attaining an objective.

WHAT, in general, are our available facilities for the training of Reserve officers?

We can send them to posts such as Fort Ethan Allen, Camp Devens, Camp Meade, etc. We can send them to schools such as Forts Sill, or Riley, or Benning, or Leavenworth, etc. Our Regular officers can never get much more than a platoon for combat problems in the field, so there is little chance of giving much of a unit to the Reservists. At an average Army post on active duty they will be swallowed up by post routine which bears no relation to warfare unless you have a sense of humor. In the Marine Corps we have the Fleet Marine Force, with a brigade on each coast. Those units do nothing but train for war. They can shove off and fight inside of a day. Without doubt the ideal place to send Reserve officers would be to such units. However, you cannot very well replace the Regular personnel. So the Reservists would have to observe most of the time. Moreover, the Army really does not maintain such outfits.

As the situation now exists, the best place for the Reservists is the artillery or infantry school, or, in short, the school of their branch. There they can learn the technique of employing weapons and their operation. They can fire numerous problems on the range. They can spend rainy days in classrooms. On occasion they can actually command a full platoon in the field, as distinguished from a platoon on the parade ground.

In conclusion it is submitted that officers from Reserve, taken on duty for any appreciable time, should be sent to the school of their arm; that such training is highly beneficial, fundamental in their education, available in peace time, relatively inexpensive, stimulating to their later studies, a means of building up their confidence and ability, and a thoroughly worth-while expenditure of the public funds. In fact, some Reservists have in the past attended Benning, Sill, etc. There is ample precedent for the support of this proposal.

It is urged especially that during such active duty, Reserve officers should be thrown in direct contact with the Regulars at the school and not quartered together in large groups with their fellow students, chiefly for the reason that contact with the Regular officers would be more stimulating to the civilians and would promote the interchange of ideas and points of view. It is also suggested that the commanding officer occasionally detail Reserve officers to take charge, for a short period, of some unit designated to perform an assigned duty for the purpose of affording actual experience in directing enlisted men.

The bulk of the training period should be devoted in the field to the employment, operation, and technique of weapons—other subjects to be considered in classroom study and map work.

It is useless to demand that these officers be given command of units at full strength in the field, because such units cannot be obtained, and if they could, the cost of maintenance would be prohibitive.

After all, the platoon is the fighting team of the service. Let the Reservists handle a platoon in a field problem occasionally. In a future war they will rarely see more than one platoon very clearly from any ordinary command or observation post. Possibly they will direct their outfits by short-wave radio, in which case they had better leave their dress swords at home when they go on duty at a school and try to pick up some information about radio sets in combat use.

Perhaps this line of argument sounds radical and novel, if not unsound. One hundred and twenty-five or more years ago a well-known authority stated, in effect, that in war, fire power is everything, other factors of but slight importance. That authority was Napoleon. Recently I saw these words on a church bulletin: "The archer is not known by his arrow, but by his aim."

Maj. Gen. Samuel Hof

1870 - 1937

THE name and military record of Maj. Gen. Samuel Hof, former Chief of Ordnance of the Army, ever will be associated with an epochal period in the annals of American military armament. His death on March 10, 1937, after a brief illness, closed a distinguished career, but it accentuated not only the place he held in the affections of his friends but also the merit which attaches to his long military service. Circumstance decreed that during his tenure as Chief of Ordnance postwar development in the fields of motorization and mechanization came to fruition. Many of the weighty problems with which American ordnance was faced in these fields following the World War had been explored and solved—and others were on the path to solution—when he became head of the Department. His was the task of administration at a time when evolved equipment was ready for limited production. This we would appraise as the climactic note of General Hof's lifelong service to the armament needs of our national defense.

GENERAL HOF
CHIEF OF ORDNANCE, U. S. ARMY
1930-1934

To note his passing in these pages is no easy task. A few days before his death, he visited our editorial offices and gave abundant evidence of his close concern for the ordnance cause. He was ever an energetic proponent of industrial preparedness as is attested by the pages of this journal for a decade past. Such visits were his custom since he relinquished the office of the Chief of Ordnance three years ago. His hearty laugh and jovial manner will be missed throughout the ordnance fraternity but by none more deeply than by the writer of these lines.

General Hof's life and work are part and parcel of the record of American ordnance. He was born at Boscobel, Wis., October 24, 1870. He was graduated from the Military Academy in 1894. After service with the Cavalry at Fort Yellowstone, Wyo., he returned to West Point as instructor of law and history and later as adjutant of the Academy. During the Spanish American War he served with the 6th Cavalry at Tampa, Fla., and Montauk Point, L. I. In June 1899, he began his service in the Ordnance Department at the Sandy Hook Proving Ground. There followed tours of duty at the principal manufacturing arsenals. In 1915 he was Department Ordnance Officer in the Philippines and Commanding Officer of the Manila Ordnance Depot. During the World War he was in command of the Frankford Arsenal and after the Armistice he was acting chairman of the Ordnance Department Claims Board, settling ordnance contracts which were canceled at the termination of hostilities. Following other important assignments in the United States and abroad, he was Ordnance Officer of the Second Corps Area in 1926 and was appointed Assistant Chief of Ordnance and Chief of Field Service with the rank of brigadier general in July 1927. He was graduated from the Army War College in June 1921, and from the Harvard Graduate School of Business Administration in 1926.

In 1930, General Hof was appointed Chief of Ordnance, the responsibilities of which he bore with distinction until his retirement from active service in 1934.

GENERAL HOF'S war service, and, indeed, the caliber of his peace-time leadership, are best expressed in the citation which accompanied the Distinguished Service Medal he wore: "For exceptionally meritorious and distinguished service in positions of great responsibility, first as Commanding Officer, Frankford Arsenal from March 1918, to March 1919, where, by his indefatigable energy, outstanding administrative ability and thorough technical knowledge, he brought to a successful production basis tracer, incendiary, and armor-piercing small-arms ammunition, and supplied substantially all that was used by our troops; later, as Acting Chairman of the Ordnance Claims Board, where, by his energy, tact, and business ability he secured the settlement of outstanding obligations and later, as Chief of Field Service, Ordnance Department, where he perfected the organization and controlled the disposition of vast quantities of materials and plants left over from the war."

He regarded the Army Ordnance Association highly. "You are the men we have depended on and will continue to depend on for industrial preparedness" were the closing words of his last address, as Chief of Ordnance, to our members.

This brief résumé recounts inadequately General Hof's contribution to ordnance progress. He was versed in the administrative and material needs both of ordnance design and production as well as the responsibilities of ordnance supply. The note he would probably like best were he to read these brief lines on his life and work would be one of simplicity. He sought the practical rather than the ideal, and in the seeking he gave the best of his talents and his energy. No soldier could desire that more be said of him. General Hof would have preferred less. L. A. C.

ARMY ORDNANCE

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Month by Month

As will be noted from two other announcements in these pages, the forthcoming annual meeting of the Army Ordnance Association will be a significant occasion. The sessions this year in Washington and at the Aberdeen Proving Ground bid fair to exceed any previous gathering of the Ordnance cohorts during the eighteen years of our Association's existence. It is anticipated that all the old stalwarts will be on hand in their customary places and that many new friends of the Ordnance cause will be in the assembly.

The Ordnance Cohorts Assemble

The selection of Maj. Gen. James G. Harbord to receive the Ordnance Medal of Merit this year will meet with the enthusiastic approval of all members. Indeed it must merit the acclaim of all proponents of our national defense. General Harbord is an exemplary figure for what he has done in the fields of military science and industrial progress. His achievements on the field of battle will stand among the great records of military heroism, while his place in the progress of American industry is an outstanding contribution to our peace-time cultural advancement. His address to our members will be fruitful for the common welfare.

We take particular pride in the announcement that Mr. Hilaire Belloc will also speak at our banquet. His name is a byword wherever things military and their history are discussed. He comes to us from England to present in person some of his views which readers of his many books will acknowledge to be fraught always with great learning and application.

Ordnance Day this year becomes Ordnance Afternoon. On the afternoon of Thursday, May 13th our members are invited to attend an engineering conference to be held at the Aberdeen Proving Ground. Two hours will be devoted to the engineering aspects of certain types of ordnance matériel and all the old fanfare of circus trappings will be discarded. This year the afternoon will be devoted to study and observation of trends in ordnance design. After all, this is the prime purpose of our Aberdeen gatherings and the great crowds of former years have prevented the concentrated attention of our engineers and manufacturers to immediate Ordnance problems. By eliminating the morning program and by sticking close to design and production aspects of our problem we hope to confine the session to our members and their friends and in so doing to leave the turmoil and the crowds of former years to the past.

So reserve the evening of May 12th in Washington and the afternoon of May 13th at Aberdeen for the 1937 assembly of the Ordnance cohorts.

"Can We Defend America" is the title of a new thought-provoking book from the facile pen of Maj. Gen. Johnson Hagood. We recommend that every student of the national defense of the United States read it. It is not criticism for criticism's sake, because the book is decidedly not that; rather it is a fearless and frank appraisal of many things we hold dear, and it is stimulating to place the square edge of Hagood opinion against the sometimes warped edge of traditional organization.

General Hagood and Defense

We had occasion to comment here upon one of the chapters of General Hagood's book when it first appeared as one of a series of articles in the *Saturday Evening Post*. The General's book presents a composite thesis in that it crystallizes for the general reader what the author believes to be the essentials of our military preparedness. Many students will find ample ground for exception to some of the things General Hagood proposes. Indeed we take serious issue with him as to the advisability of changing the organization for industrial mobilization planning within the War Department. Likewise there are ample reasons why his position regarding a GHQ Air Force will not meet with general acquiescence. On the other hand his plea for a revitalization of coast artillery, his defense of munitions preparedness, his appraisal of the civilian components of the Army, and his simplified method of training are all subjects which the unbiased reader must admit weigh heavily in General Hagood's favor.

But the most important thing about this book is that it presents an unfettered, logical view. And this is a real achievement. For it must be admitted, much to the regret of thinking men, that here in the United States our competent military spokesmen do not discuss and frankly express opinions on military matters with the freedom, and consequently with the advantage, they deserve. If military thought is to progress among us and not become a hide-bound, hard-shelled dogmatic thing, we must have analysis freely presented. If we do not, our plight is a sad one.

We also recommend to our readers a booklet published recently by the National Council of American Shipbuilders entitled "Commercial Shipyards and the Navy." The Council has made an elaborate fact-finding study of the proposal that American naval construction be confined to Government yards to the extinction of the private naval building industry. When the present Navy Bill making appropriations for the next

Ships and Men

fiscal year was presented to the Congress recently, proponents of Government manufacture again took up the cudgels to urge a Government monopoly of construction under the Navy program. So the issue is very much alive.

So many half truths have been advanced and are repeated particularly with respect to comparative costs—so many of the old canards as to the business ethics of shipbuilders are kept alive—that the average citizen has an inaccurate picture of the situation. Furthermore, nationalization of the shipbuilding industry is proposed by the same elements which urge the nationalization of the arms industry. The arguments and the tactics used in both cases are quite the same.

BEFORE the World War, the name of General P. Charbonnier of the French Naval Artillery was well known to American Ordnance officers and Artillerymen for his research in ballistics. During the war and in the years following many American officers had the privilege of knowing personally this eminent ordnance expert not only in France, but also in the United States, where in 1922 General Charbonnier was a welcome visitor as head of the Naval Artillery Technical Mission. In all these many contacts, the General by his unfailing courtesy, his friendly affability and his patience in discussing at great length problems of ordnance design and utilization gained for himself and for his country a host of friends. They will grieve to learn of his recent death that has deprived France of the services of one of her best technicians, and America of one of her warmest friends in a foreign land.

A GREAT ORDNANCE EXPERT

General Charbonnier devoted the last years of his life to directing the *Memorial de l'Artillerie française,* the technical periodical that is unique among ordnance publications of the entire world. He was stricken while writing at his desk in his office. His last thought, as well as his activities during so many years, were devoted to the profession which he had advanced so greatly by his labors. For instance, in the field of ballistics he was a pioneer. Before him this science was almost exclusively empirical. He will always be known as the mathematician who advanced ballistics from its empiricism to its present status of an applied science. American officers who have listened to his lectures on ballistics and on ordnance design recall his clear logic, his profound knowledge and his open-mindedness.

In recording his death in these pages to which he was a contributor on several occasions, it is difficult to decide whether we grieve more for the loss of a great ordnance expert or for the loss of a friend, warm-hearted, sincere and kind.

IT is not our custom in these pages to plead the cause of membership in the Army Ordnance Association. Nor do we intend to depart from this policy now. However it has been suggested by some readers that a word might be said now and then to good purpose in the hope that a healthy growth in membership might be brought about without inconvenience or trouble to anyone. We will leave to others to say what good purpose our organization performs now and what it has helped to achieve during the past eighteen years. That record is plain for all to see. It is creditable.

A.O.A. MEMBERSHIP

It is a fact that membership in such an organization as ours reflects accurately the general business condition of the country. When economic conditions are bad membership falls off. When they improve membership gains. This formula again will apply unless there has been a fundamental change of attitude of our engineers and manufacturers toward our national defense. Certainly the principles of industrial preparedness are more vital today to our national security than they have ever been and it would be a fine thing, we believe, for the country at large if our numbers were increased materially in order that the principles of armament preparedness might be better known and understood. We ask the coöperation of all members toward a larger enrollment in America's one organization pledged to industrial preparedness as our strongest guarantee of peace.

THE War Department recently requested the Congress to enact legislation under which samples of Army equipment can be given or loaned in peace time to manufacturers. The legislation is desired in order that, in the words of Secretary of War Woodring, "civilian commercial factories may become familiar with the manufacture of certain items of war munitions not directly related to their peace-time production, particularly some of the articles required by the Ordnance Department and the Chemical Warfare Service."

AN OBJECT LESSON

After years of effort, the country still lacks a program of "educational orders" for ordnance manufacture. Unsuccessful attempts have been made during more than a decade to secure legislative warrant for this type of production, but to no avail. The record shows plainly that a major military effort on the part of the United States requires from a year to eighteen months to achieve maximum production of ordnance. Educational orders in peace time would reduce this lag materially and save countless lives, hours, and dollars.

The next-best thing to educational orders seems to be embodied in this proposed legislation. Our private manufacturers are asked to make studies of our designs of equipment with a view to war-time production. Specifications and drawings are usually available, but these are far from satisfactory for educational purposes. Our civilian engineers will be able to talk the ordnance language much more fluently by having studied over, taken apart, and reassembled the equipment itself rather than a paper description of it. The bill provides: "That the Secretary of War is hereby authorized, in his discretion and under rules, regulations, and limitations to be prescribed by him, to sell, loan, or give to contractors and private firms which are or may likely be manufacturers or furnishers of supplies and equipment for the use of the War Department or of the Army, under approved production plans, such drawings, manufacturing and other information, and samples of supplies and equipment to be manufactured or furnished as he may consider will best promote the interests of national defense."

If the law is enacted it would be a good idea to place in the engineering department of every American company which has accepted a schedule of war-time production, at least one each of the finished items it will produce. In this way the potential war-time producer will not be an absolute stranger to the product he will have to make in time of war.

Arms and Neutrality

An Editorial

AT this writing the Congress is in a turmoil over the "new" concepts of American neutrality as expressed in "The Peace Act of 1937." The Senate has passed the so-called Pitman Bill, the House has passed the McReynolds Bill. Similar in many details, their distinguishing mark lies in the fact that the first is essentially mandatory legislation and the second is primarily discretionary. Some observers feel that the wide divergence between these two approaches may prevent agreement on any new legislation, and as a result the present act, which will expire at the end of May, may be renewed for another year or two.

The great confusion of thought apparent throughout the Congressional debates and the marked cleavage of editorial opinion indicates that a clear understanding of neutrality is not easy of attainment and that, after two years of foment, hysteria still is the basis of popular approach. If the "new" neutrality becomes permanent national policy along the theory of mandatory embargoes, it will be proof positive that emotionalism reigns where only deep, sober, and effective thinking should predominate.

The distinguished Congressman from New York, Mr. James W. Wadsworth, legislative author of our National Defense Act of 1920 and former chairman of the Military Affairs Committee of the Senate, expressed the view of realistic Americans when he said of the "new neutrality" during the Congressional debates, "America decides by the passage of legislation of this kind never again to give encouragement to struggling little peoples and decides that if the strong are strong enough she will do business with them. We are doing a disservice to liberty. . . . I am not casting aspersions upon the motives, much less the intelligence, of my colleagues, but this bill is going to pass because we are in a state of hysteria. That I believe to be the case. But, be that as it may, I view its passage with a sinking heart."

It is not within the scope of this journal to develop or propound the basic principles of the international law of neutrality. This we leave to such authorities as John Bassett Moore, Charles Warren, J. Allen Dulles and a score of other qualified experts whose unbiased opinion is worthy of deep consideration. This opinion has been expressed for all to read. We are within our province, however, when we discuss here some of the extreme notions about arms and armament which, in the United States, have become preponderant present-day neutrality discussion. On this score we share the concern of Mr. Wadsworth. Every sincere student who analyzes the problem factually instead of emotionally must come to the conclusion that our national thinking on so fundamental a subject has wandered far afield. Indeed the well-being of the United States, to say nothing of the peace of the world, is seriously jeopardized by the new-fangled, League of Nations-born idea of arms and armament control as the determinant of security at home and abroad.

FOR those readers who share this belief it may be worthwhile to review some facts in their direct relation to our own national well-being. For years in these pages stress has been placed upon the orthodox meaning of our national defense, of our attitude toward peace and war, and a correct understanding of the relation of arms and arms production to both. It is not now necessary to repeat and reaffirm these earlier views. They will stand the test of time; their proof will be as definite in the future as in the past. But newer evidence is at hand to emphasize the absurdity of the peace-at-any-price jargon about arms and neutrality. Let us examine this evidence briefly.

Foremost of these factors is the first annual report of the National Munitions Control Board for the year ending November 30, 1936. (House Document No. 10, Seventy-fifth Congress, 1st Session; procurable from the Superintendent of Documents, Washington, D. C., at fifteen cents a copy.) In the last issue of this journal, reference was made to some of the salient points of the first year's operation of munitions control in the United States. At that time only a résumé of the report was at hand. Now it is available in complete text. This document is worthy of intense study by every student of arms and neutrality. We repeat a compliment extended in the last issue to the officials of the Board, not only upon their attitude toward this much misconstrued question but also for their thoroughness in presenting the data.

The most significant of all the assembled data relate to the number of manufacturers, exporters and importers of arms, ammunition, and implements of war in the United States. The wording of the report tells its own story. It reads, "On October 5, 1935, the Secretary of State addressed a letter to *817 persons and companies* inviting their attention to Section 2 of the Joint Resolution (registration with the Board) and requesting that they register in case the business in which they were engaged came within the terms of its provisions. *One hundred and forty-nine persons and companies* have now (December 1, 1936) registered as manufacturers, exporters or importers of arms, ammunition, or implements of war pursuant to the terms of the Joint Resolution." (Italics ours.)

We hear it said time and again that the United States is one of the major arms-producing countries, and that as such its arms production has a definite bearing upon neutrality. The report should repudiate that misstatement once and for all. The Board *thought* that there were in this country a possible 817 persons and companies in the arms business subject to registration. *There turned out to be 149!* But by no stretch of the imagination are these 149 producers of arms. And for the simple reason that classified as manufacturers, importers and exporters of arms, ammunition, and implements of war under the so-called neutrality law are the producers of such nonmilitary items as commercial aircraft, propellers or air screws, fusilages, hulls, wings, tail units, under-carriage units and aircraft engines. Hence the total number of licensees includes practically the entire aircraft industry of the United States. Which, of course, is the most childish kind of neutrality legislation. There is no more reason why nonmilitary aircraft should be classed as arms, ammunition, and implements of war than that, for instance, commercial automobile trucks should be so classed. When one attempts to draw the line of demarcation between military and nonmilitary equipment he comes back squarely to the obvious conclusion that there is no such common-sense line.

Be that as it may, an analysis of the arms situation in the United States for the past year, as disclosed by the Board's report, shows that there are not more than two dozen actual arms exporters, that more than half of these are producers of small arms, that the great bulk of money value is in small-arms ammunition, that there are scarcely half a dozen producers of larger ordnance equipment, and finally that there is not in the United States today a producer of the larger types of heavy guns! For this confirmation of a known condition the country will be grateful to the Board. For those of us who believe a trained private ordnance industry to be necessary to our national well-being there is in this disclosure cause for grave concern.

BUT the point we wish to make is that arms are not the essence of neutrality. In fact, as Congressman Wadsworth implied, embargoes of arms either to belligerents or to countries wherein there is major civil strife, can easily become distinctly unneutral. One has only to recall that the lists of contraband decreed during the World War grew to such proportions that arms as such held a decidedly minor place in the catalog. And there are abundant reasons why this will be repeated in any future war. Consequently, to adopt as national policy a plan which automatically prevents the supply of weapons while it allows freedom of supply of all other essentials, can be called idealistic, or pacifistic, or any number of other high-sounding adjectives but it cannot be called neutral.

The essence of neutrality is impartiality. Until the close of the World War the accepted meaning of impartiality was that a sovereign state, regardless of size, possessed not only the right but the duty to supply all other belligerent states the things they desired—food, clothing, raw materials and everything else, including arms. Now comes the fallacious theory that in war there can be no neutrals—a pious platitude which has no basis in fact. This idea was born in the mistaken belief that a League of Nations would guarantee collective security, that when one member of the League was attacked all the others would join forces against the aggressor. Such a theory is predicated on the obvious fact that neutrality and a League of Nations are mutually exclusive. Today, with the League scuttled, the League-born theory of neutrality, or more accurately, embargo, is still afloat. Especially is this so among shallow people in the United States who hold that arms are a cause of war.

Four things are vitally wrong with the "new neutrality". The first is that it is not neutrality. The second, that it automatically embargoes the shipment of arms, ammunition and implements of war, as defined, but permits the unlimited shipment of anything and everything else—which is downright foolishness. The third, that it contradicts itself by classifying civil aircraft as an implement of war. The fourth is the preposterous logic that a neutral decides what is contraband and sets himself up to enforce his decision. All this is bad enough. But add to it flouting of experience. For example, the Declaration of London, as recently as 1909, contained this important provision in Article 23: The following articles, susceptible of use in war as well as for purposes of peace, may, *without notice* be treated as contraband of war, under the name of conditional contraband: (1) foodstuffs; (2) forage and grain, suitable for feeding animals; (3) fabrics for clothing, and boots and shoes suitable for use in war; (4) gold and silver in coin or bullion and paper money; (5) vehicles of all kinds available for use in war and their component parts; (6) railway material, both fixed and rolling stock, and material for telegraphs, wireless telegraphs, and telephones; (7) balloons and flying machines and their component parts; (8) fuel and lubricants; (9) powder and explosives; (10) barbed wire and instruments for fixing and cutting the same; (11) horseshoes and shoeing materials; (12) harness and saddlery; (13) field glasses, telescopes, chronometers and all kinds of nautical instruments. In the World War, practice proved that there was scarcely anything except medical supplies which was not contraband. So it will be again.

Now the point that matters most in this new philosophy is this: We have hysterically come to believe that arms make war and if there are no arms there will be no war. We go further and declare that civil aircraft are implements of war and that civil automobiles are not. We go still further and we say to every country on earth: "If you get yourself into a war or if, much against your will, somebody else gets you into it, or if a handful of Communist agitators gets you into a civil war, you are out of luck—the United States cannot let you have a rifle, or a round of ammunition, or an airplane. You can have all the cotton and wheat and sugar and oil you can haul away, cash on the barrel head before you take it." And what a bungling of the real meaning of national defense for ourselves and for the other countries of the world all this is! But, if the cash is on the barrel-head, we will sell (at fancy prices!) the cotton and wheat and sugar and oil; and we are thus neutral (God help us!) as long as we ship no "arms, ammunition and implements of war"!

This conclusion has nothing to do with the other features of the Peace Act of 1937. The Act attempts to provide an f. o. b. neutrality. Under its terms we are willing to renounce our traditional doctrine of freedom of the seas; it is discriminatory in that it automatically aids the strong country able to effect a blockade and similarly penalizes the weak country having no such naval power. It restricts freedom of action of American citizens and renounces the protection of government to those citizens who are in the war zone or on the seas. These renunciations the American people may be willing to make today in their mistaken belief that some prearranged formula will take the place of diplomacy and national leadership in keeping us out of war. Maybe they are worth trying simply to prove the falsity of the contention. But the fact remains that the arms agitation in the United States has been built up to such grotesque proportions that healthy concern for our own ability to produce has become a national heresy, and we have built a gigantic house of cards on the weak assumption that arms embargo is a guarantee of peace. The plain fact is that too many of us are thinking of the next war in terms of the last, and to do so is sheer folly. What we need far more than academic legislation under the name of neutrality is a broad, solid understanding of the causes of conflict and their cure. Maj. Gen. J. F. C. Fuller, writing in his latest book, "The Last of the Gentlemen's Wars—A Subaltern's Journal of the War in South Africa 1899-1902," sums up the thought in these words, "Do not let us forget that chivalry in war is as important as killing, because on the cleanness with which a war is fought will depend the cleanness of the peace which one day must follow it." Let us hope that common sense will replace foolhardiness when we think in terms of arms and neutrality and that our actions as a nation will be governed by justice for ourselves and for others.

Association Affairs

EIGHTEENTH ANNUAL MEETING

ALL members of the Army Ordnance Association will have received by this time personal invitations to attend the sessions of the Eighteenth Annual Meeting to be held on May 12th and 13th. The annual banquet, as announced in this issue, will be held at the Mayflower Hotel in Washington, D. C., at 7 P. M., Wednesday, May 12th. The following afternoon, Thursday, May 13th, members of the Association are invited to attend an engineering conference to be held at the Aberdeen Proving Ground, Md., beginning at 2 o'clock. Both sessions of this meeting are of such significance as to warrant a goodly attendance.

At the Washington session, the honors of the Association will be conferred upon Maj. Gen. James G. Harbord, whose distinction in military and civil life is world-wide. The Committee on Award which chose General Harbord to be the recipient of the Ordnance Medal is under the chairmanship of Col. Frederick H. Payne, vice-president of the Association and former Assistant Secretary of War. The members of the Committee are Mr. Edmund A. Russell, president of the Chicago Post, and Mr. Frank B. Bell, a director of the Pittsburgh Post. The medalist will be presented by the chairman of the Committee and the medal will be conferred by Brig. Gen. Benedict Crowell, president of the Association, who will preside at the banquet and the ceremonies following.

Members of the Association who attend this session of the meeting will have the rare good fortune to hear addresses by two distinguished speakers: General Harbord and Mr. Hilaire Belloc of England. General Harbord will talk on "Radio and Industrial Preparedness," a theme on which he is especially qualified to speak. He rose in the United States Army from the ranks to command the illustrious 2nd Division in France and later to operate the Services of Supply—that great organization which was responsible for equipping and provisioning the millions who served in the A.E.F. Later he was chosen to be Deputy Chief of Staff, and upon his retirement from the Army in 1922 he became chairman of the board of the Radio Corporation of America, which office he now holds. Mr. Belloc, by general acknowledgment, is the foremost military historian of our day. His writings and discussions over many years have won for him a preëminent place among military and economic analysts. He will address our meeting on the important subject, "Yesterday's Wars Are Not Tomorrow's."

Reservations for the banquet must be received by May 8th. Members are urged to make their arrangements well in advance Tickets may be procured from the office of the executive secretary, 806 Mills Building, Washington, D. C., at $3.50 each.

The engineering conference to be held at the Aberdeen Proving Ground the following afternoon, Thursday, May 13th, is a departure from our former Aberdeen visits. It has become increasingly impossible to accommodate at the Proving Ground the vast crowds on "Ordnance Day." Safety precautions, traffic congestion and inadequate meals facilities, with each passing year have become limiting factors in accommodating visitors. Furthermore, the Association's gathering at the Proving Ground has always aimed to be an engineering and professional meeting. This it could not be under recent conditions. The crowds were so great and the accommodations so limited that members were unable to see and study the engineering technique of ordnance equipment which is the prime purpose of the gathering. At the coming Aberdeen meeting many of these objections will be overcome by confining the agenda to an afternoon session instead of an all-day program as heretofore. Hence, *on May 13th, the Proving Ground will be open to members beginning at 1:30* P. M. The exhibition itself *will be confined to the Main Front and will begin at 2 o'clock, continuing until 4 o'clock.* Members wishing to examine equipment will be allowed another hour from 4 until 5 o'clock for inspection. We wish to remind members who travel to the Proving Ground for this engineering conference that meals will not be available, and we suggest that those who travel by automobile make use of restaurant facilities in nearby towns: Aberdeen, Bel Air, Havre de Grace, etc., for luncheon *before arriving at the Proving Ground at 1:30.* Safety precautions again make it necessary to limit attendance to members and their gentlemen guests; ladies will not be admitted.

Due to the recent general reduction in railroad fares, special rates for this meeting are not provided. However where twenty-five or more members and guests from any one city travel either to the Washington or the Aberdeen session *on the same train,* a special reduction of one-fourth of the regular round-trip rate will apply on the Pennsylvania Railroad. It will be necessary only to notify the ticket agent at place of origin, and if the minimum number of twenty-five on a particular train is assured, the special reduction will be granted. Two trains in particular will conform to these requirements. Members from Baltimore and Washington are urged to make the journey to Aberdeen on train No. 132 leaving Washington Thursday, May 13th, at 12:05 o'clock, leaving Baltimore at 12:50, arriving at Aberdeen at 1:20 P. M. Similarly, members traveling from New York, Philadelphia and Wilmington will find train No. 121 most convenient. It will leave New York at 10:30 A. M., Philadelphia (30th Street) at 12:16, Wilmington at 12:45, arriving at Aberdeen at 1:21 P. M. Arrangements have been made for special stops on regular trains north- and south-bound after the meeting, leaving Aberdeen at about 5:15 P. M. (*Hours given are Eastern Standard Time.*)

The program of tests this year will be confined to mobile artillery and automotive equipment with particular reference to engineering and production problems. Equipment shown will be explained by officers familiar with design characteristics. There will be no program of gun firings; time and attention will be devoted to the study of a few types of new equipment rather than to many with which members are familiar.

Industrial preparedness is becoming more and more the pressing military problem of the United States. It is to be hoped that this year all members will avail themselves of the opportunity to attend the banquet and meeting in Washington—where they will hear timely discussions of our national defense—and to be present at the engineering session at Aberdeen to witness a program of unique professional interest.

LOS ANGELES

WHAT better account of the gala meeting of the Los Angeles Post could there be than the following transcript received from Capt. Ralph Cook Scott, secretary of the Post? The meeting was held at March Field, Calif., on Sunday, March 21st. We were about to prepare a somewhat prosaic account of the gathering when the following from Captain Scott was received just as ARMY ORDNANCE went to press. We wish to add a prescript to the account simply to convey congratulations to the officers and members of the Post on what appears to be the inauguration of an annual Ordnance Day on the West Coast.

"Driving down to March Field from Los Angeles we passed through miles of fruit trees in blossom and the low hills were emerald-green and the far distant mountain range capped with snow—sunshine all day and no wind—so flying conditions were perfect. At 10:15 our president, Mr. Earl Gilmore, arrived in his Lockheed ship with a party of five.

"A fine display of ordnance equipment was arranged on tables

in front of the theater and a number of NCO's explained the uses and functions. Brig. Gen. D. C. Emmons welcomed the group to March Field. Col. John H. Pirie gave a brief outline of the Air Corps organization. Capt. Philip Schwartz, officer of the day, led the group about the field.

"An appetizing lunch was served at the Officers' Club and 180 were seated at table. Many others who had no reservations were sent elsewhere to eat. At 1:30 we were on our way again and our schedule was followed to the minute.

"The program was alive—startling and very interesting. Credit for this fine day at March Field belongs to Captain Schwartz whose planning and efforts made it a success. The events moved on time and the crowd was ushered from place to place by a squad of NCO's. All reported a fine time and expressed a desire to come again. We planned to make this an annual affair."

COL. JOHN E. MUNROE

COL. JOHN E. MUNROE

COL. JOHN E. MUNROE, chief of the Technical Staff of the Ordnance Department, died at the Walter Reed Hospital in Washington March 8, 1937, after a brief illness. His death removes from the roster of the Department one of its most capable officers and from the roll of the Army Ordnance Association a charter member who had taken a characteristically retiring but valued place in its activities. At the time of his death he carried engineering responsibilities as chief of the Technical Staff of the Department which are second to none.

Colonel Munroe was born at Worcester, Mass., January 29, 1881. He was graduated from the United States Military Academy in 1902. Commissioned a second lieutenant of Artillery, he was later detailed to the Ordnance Department in which he served almost continuously for nearly thirty-four years. Having served through the grades and at many of the Ordnance establishments, he was chief inspector of small-arms ammunition at the beginning of the World War, having been stationed in the Inspection Division, Ordnance Department until December 1918. He was chief of the Equipment Branch, G-4, of the War Department General Staff, to which he was assigned following graduation from the Army War College in 1926. Before assuming his duties as chief of the Technical Staff in August 1934, he was commanding officer of the Frankford Arsenal.

The genteel tradition of his native New England had its best portrayal in this splendid officer. Colonel Munroe was unassuming, calm, and gentlemanly at all times. His ability as engineer and administrator was displayed in the character of his achievement rather than in the manner of its performance. His large circle of friends was drawn to him as much by his kindly graciousness as his good judgment and sound leadership. He gave in great measure the best of his fine ability to the military profession of which he was an honored exponent.

PITTSBURGH

BEFORE this issue of ARMY ORDNANCE appears, the annual dinner meeting of the Pittsburgh Post will have been held on the evening of April 24th. Col. H. A. Gidney, president of the Post, has arranged an interesting program. Invitations to address the gathering were accepted by Maj. Gen. William H. Tschappat, Chief of Ordnance; Brig. Gen. Herman W. Schull, chief of the Manufacturing Service; Brig. Gen. Benedict Crowell, president of the Army Ordnance Association; Col. C. T. Harris, Jr., chief of the Planning Branch of the Office of the Assistant Secretary of War, and Maj. L. A. Codd, executive secretary of the Army Ordnance Association. Further details of the meeting will be published in the next issue.

HARTFORD

ALL members of the Army Ordnance Association, especially those in the New England area, are invited to attend the annual meeting of the Hartford Ordnance District to be held on the evening of May 20th. Col. B. A. Franklin, chief of the Hartford Ordnance District, assisted by Col. Frederick H. Payne, assistant district chief and a vice-president of the Army Ordnance Association, are in charge of arrangements. These annual meetings of the Hartford District are among the principal ordnance gatherings of the country. In recent years they have been attended by many engineers and manufacturers who are associated with the district in industrial mobilization planning. Col. Francis H. Miles, Jr., is the executive officer of the district. Invitations to the meeting, to be held at the Hotel Bond, Hartford, will be sent to all members of the Association in New England.

ARMY ORDNANCE SCHOLARSHIP KEYS

FOLLOWING a practice adopted several years ago, the Army Ordnance Association again will present keys for proficiency in scholarship to honor students of Ordnance units, Reserve Officers' Training Corps. These honors are awarded under the direction of the officers in charge of military science at the several colleges and universities where Ordnance units are maintained.

Such units are in operation at University of California, University of Cincinnati, Cornell University, Georgia School of Technology, Lehigh University, Massachusetts Institute of Technology, University of Michigan, Stanford University, and University of Oklahoma.

Two keys are presented by the Association to each unit, the awards usually being made to the honor student in the senior and junior courses respectively. The names of the winners and accounts of the ceremonies at which the awards are usually presented will be published in these columns.

At University of Cincinnati, the scholarship keys were presented at a military convocation in Wilson Auditorium attended by all R.O.T.C. students and a number of distinguished officials and guests.

Among these were Dr. Raymond Walters, president of the University; Col. F. C. Endicott, Chief of Staff, Ohio Military Area; Lieut. Col. Manning M. Kimmel, Jr., Executive Officer, Cincinnati Military District; Lieut. Col. Oscar Krupp, Executive Officer, Cincinnati Ordnance District; and Maj. James M. Robinson, Infantry Officers' Reserve Corps, president of the Ohio Reserve Officers' Association.

One of the keys, known as the Cincinnati Ordnance District Medal, was awarded to Cadet Sergeant Elbert S. Hizer, of Cincinnati, Ohio, a junior in the College of Engineering and Commerce. His average military grade for the second and third terms of his pre-junior year and the first term of his junior year was 94.86.

The second key, known as the Army Ordnance Association Medal was awarded to Cadet Sergeant Warren L. Wurster, of Silverton, Ohio, a pre-junior in the College of Engineering and Commerce. His average military grade up to and including the first term of his pre-junior year was 91.81.

The awards were presented by Colonel Krupp, who also gave a brief talk on the aims and ideals of the Army Ordnance Association.

At Stanford University, keys were presented to Richard MacGowan and Robert Schuck by Maj. Gen. George Simonds, Com-

manding the Ninth Corps Area, at the annual inspection and review of the Reserve Officers' Training Corps.

Mr. MacGowan, son of Lieutenant Commander MacGowan, U. S. Navy, Ret., is a senior in the College of Chemistry. Mr. Schuck, of Palo Alto, Calif., is a junior in the College of Chemistry.

At University of Michigan, the Ordnance scholarship key was presented to Mr. Melville G. Hyatt at the final ceremony of the R.O.T.C. Regiment at the end of the first semester. Mr. Hyatt is student captain and regimental adjutant of the R.O.T.C., a member of the varsity band, Scabbard and Blade, student A.S.M.E., and was a member of the track team for two years.

DIRECTORS' MEETING

THE annual meeting of the trustees and directors of the Army Ordnance Association was held at the Metropolitan Club, New York City, February 18, 1937. The following were present: Benedict Crowell, president; Frederick H. Payne, vice-president; Robert P. Lamont, director; Samuel McRoberts, director; James L. Walsh, director; John Ross Delafield, counsel; Chas. Elliot Warren, treasurer; and L. A. Codd, executive secretary. By invitation of the board, Col. Earl McFarland, Ordnance Officer, Second Corps Area, and Col. H. K. Rutherford, Executive Officer, New York Ordnance District, also were in attendance.

A résumé of the agenda of the meeting follows: The president welcomed Colonel Payne, recently elected a vice-president of the Association. He recalled that Colonel Payne had served with distinction as the Assistant Secretary of War from May 1930, to March 1933, that he is a charter member of the Army Ordnance Association and always has been most active in the advancement of its aims. The president also recalled that Colonel Payne served as assistant chief of the Bridgeport Ordnance District during the World War and upon his retirement from the office of Assistant Secretary of War he resumed his old affiliation with the district. Colonel Payne expressed his pleasure at being associated with many of his Ordnance comrades, his gratification upon his election to serve on the Association's board of officers and his desire to be of service in fulfilling the aims and purposes of the organization to the best of his ability.

The first business to come before the meeting was the report of Brig. Gen. Chas. Elliot Warren, treasurer. General Warren's report disclosed receipts from all sources during the year were $19,472.53. Expenditures for all purposes during the year were $21,284.05. Excess of cash expenditures over cash receipts for the year, with all bills paid, was $1811.52. The financial records of the Association were audited as of December 31, 1936, by Messrs. Ernst & Ernst, certified public accountants. A transcript of the balance sheet as of that date is:

ASSETS

Current			
Petty cash fund		$ 20.00	
On deposit and in transit:			
Irving Trust Company, New York	$ 658.50		
The Cleveland Trust Company, Cleveland, Ohio	1,322.44	1,980.94	$ 2,000.94
Other Assets			
Securities owned (market value)		28,258.75	
Postage		98.98	28,357.73
Permanent			
Furniture and fixtures (nominal value)			1.00
			$30,359.67

LIABILITIES

Unearned Income			
Prepaid membership dues		$ 5,699.00	
Prepaid subscriptions to magazine		1,039.50	$ 6,738.50
Reserves			
Endowment fund		$ 822.50	
Life memberships		2,100.00	2,922.50
Operating Reserve			20,698.67
			$30,359.67

A vote of particular thanks was tendered to General Warren for his services as treasurer.

The annual report of activities for the year was presented by the executive secretary. It disclosed a small net gain in membership for the year. The membership in good standing, exclusive of subscribers for ARMY ORDNANCE, was 2608 as of December 31, 1936. During the year fifteen new group members were enrolled. The Spruance endowment, providing for members of the Association among the faculty and students of the School of Engineering at Princeton University, continues to function satisfactorily. There are now twenty life members enrolled. During the year the Los Angeles Post was established.

The budget for 1937 as submitted in the report anticipates receipts of $24,500 ($4000 of which will be from surplus, if necessary) and expenditures in the same amount. Col. James L. Walsh, a director of the Association, was appointed to serve on the board of trustees for one year, the term expiring December 31, 1937. The following officers were unanimously reëlected by the board for terms of office of two years, to December 31, 1938: treasurer, General Warren; counsel, General Delafield; executive secretary, Major Codd.

The following minute in tribute to the memory of Col. Charles L. Harrison, late a director of the Association, was presented by Colonel Walsh and unanimously adopted to be spread upon the records of the Association:

"The officers and directors of the Army Ordnance Association, on behalf of the entire membership, record with deep sorrow the death, on December 16, 1936, of their distinguished colleague, Col. Charles L. Harrison, late a director of the Association.

"Charter member, former president of its Cincinnati Post and chief of the Cincinnati Ordnance District, who for seventeen years had served with distinction on our board, Colonel Harrison was a man of unusual talents as attested by the success and high esteem which came to him in his personal and professional enterprises. Our organization and the Army were most fortunate in being among the objects of his concern. His loyalty to the cause to which our organization is dedicated was expressed on many occasions and whatever progress industrial preparedness in the United States has achieved is due in no small measure to his active participation in it. In his passing we are deprived of a dear friendship, our organization has lost one of its valiant promoters.

"At this, their first formal meeting since the death of Colonel Harrison, the officers and directors spread upon the record of their proceedings this attestation of their sorrow."

Copies of this resolution were sent to members of Colonel Harrison's family.

Plans for the Eighteenth Annual Meeting of the Association were discussed as announced elsewhere in this issue.

MASSACHUSETTES INSTITUTE OF TECHNOLOGY

THE local post of the Army Ordnance Association which was informally established many years ago at the Massachusetts Institute of Technology was reorganized during the early part of this year and bids fair to become an active center of ordnance engineering. Under the new charter of the Post, recently adopted, forty-one members are enrolled. As student members of the A.O.A., they will be entitled to student membership rights and privileges. The newly elected officers of the M.I.T. Post are: president, Walter F. Kaufman; vice-president, William H. Austin; secretary-treasurer, David J. Torrans.

The calendar of Post activities for the immediate future includes a visit to the Watertown Arsenal. On April 27th, Col. Burton O. Lewis, assistant chief of the Ordnance Technical Staff, will address the members of the Post and their guests on "Ordnance Automotive Development." The combined professional societies of M.I.T. will be invited to this meeting.

Maj. H. A. Nisley, Ordnance Department, who is in charge

of the Ordnance R.O.T.C. Unit and a member of the Department of Military Science at M.I.T., has assisted the students in the reorganization of the Post. Well known as an automotive engineer who has successfully undertaken important assignments in the ordnance automotive program, Major Nisley has assisted the students in their plans for more active ordnance participation. The A.O.A. now resumes its place with the other engineering societies at Boston Tech as a medium of professional service to the national defense.

ORDNANCE ENGINEERING

MUCH interest has been shown in the modernized field-artillery equipment, particularly as displayed by various units of the National Guard, at recent local meetings of the Association. Inquiries have been received from members as to the design of the pneumatic-tired adapter by which horse-drawn field guns are modernized to permit high-speed transportation and firing. Nearly all regiments of light field artillery in the National Guard of the United States have been converted from horse-drawn to truck-drawn organizations. The draft horse has been replaced by the light commercial truck.

Many engineers—civilian and military—have devised successful modifications of the old wooden-wheel carriages. The adapters used on the box-trail field pieces of the National Guard and many units of the Regular Army were developed by A. P. Buquor, assistant to the president of the Martin-Parry Corporation, York, Pa. This mechanism adapts the axles, wheels, and brakes of the guns to permit trailing at high rates of speed without prejudice to firing efficiency and enables firing directly from rubber tires. The rate of march of artillery has been increased enormously—the former five miles an hour of horse-drawn units being replaced by forty miles an hour on paved highway. Mr. Buquor, who was closely associated with the Chemical Warfare Service during the Russian Expedition, designed and built Mexico's first motor car, the Anahauc. He is a member of the Society of Automotive Engineers and of the Army Ordnance Association. He holds nearly fifty patents in the United States and foreign countries for gun carriages and truck equipment designed to increase the carrying capacity for standard 4-wheel trucks.

This development has had remarkable success in our National Guard. While all types of truck-drawn artillery have the decided advantages of speed and reduction of operating costs, such a development permits organizations which have limited training periods to maneuver equipment at great distances with maximum efficiency. As a typical instance, during summer maneuvers the truck-drawn 145th Field Artillery of the Utah National Guard marched over deserts and mountains from Salt Lake City to San Luis Obispo, Calif., for training with the 40th Division. The distance for the round trip was over fifteen hundred miles across waterless wastes at high temperatures. It was executed in about a week. This compares with a former maneuver limited to about one hundred and thirty miles during a week.

NEW MEMBERS

THE following have been admitted to membership in the Army Ordnance Association: Philip A. Anton, Fort Myer, Va.; Nicholas A. Athanason, Fort Barrancas, Calif.

Claude V. Baker, Presidio of San Francisco, Calif.; J. O. Baker, Watertown, Mass.; John C. Bamford, Chilkoot Barracks, Alaska; Carl Barker, St. Louis, Mo.; R. P. Bascom, St. Louis, Mo.; William Bedell, Orange, N. J.; Eugene M. Bell, Little Rock, Ark.; Marius E. Bergevin, Madison Barracks, N. Y.; Edward Bergman, Fort Sam Houston, Tex.; John M. Biggins, Elgin, Ill.; R. G. Bohn, Battle Creek, Mich.; C. A. Bond, Royston, Ga.; Walter L. Bond, New York, N. Y.; Bert Brenner, New York, N. Y.; E. F. Britten, III, Orange, N. J.

George W. Carle, Jr., Ann Arbor, Mich.; Jesse Carmack, Fort Banks, Mass.; Lee S. Chadwick, Cleveland, Ohio; Archie Chilstrom, Fort Sill, Okla.; Gardner Colman, Highland Park, Mich.; J. H. Collier, Chicago, Ill.; A. L. Cornell, St. Louis, Mo.; H. E. Corr, Elgin, Ill.; John H. Craige, Philadelphia, Pa.; William H. Crown, Jr., Philadelphia, Pa.; George H. Currett, Fort Tilden, N. Y.

G. deBethune, New York, N. Y.; Abram C. Denman, Los Angeles, Calif.; L. P. DeVau, Cleveland, Ohio; Jack B. Dudley, Fort Sam Houston, Tex.

Sol Einstein, Cincinnati, Ohio; S. S. Ellsworth, Simsbury, Conn.; Hans R. Embacher, Brooklyn, N. Y.; Royal L. Esch, Fort Hoyle, Md.

C. H. Farmer, Dover, N. J.; Bernhard Fink, Palisade, N. J.; L. C. Fisher, Washington, D. C.; Morris W. Frack, Tulsa, Okla.; Benjamin W. Freeman, Cincinnati, Ohio.

Charles A. Gebhardt, Fort Worden, Wash.; Charles Getz, Benicia, Calif.; Gordon C. Gillies, Chicago, Ill.; John H. Goff, Fort Douglas, Utah; Gilvary P. Grant, Bingham Canyon, Utah; M. E. Grant, St. Louis, Mo.; Allen F. Grum, Rock Island, Ill.

R. G. Harder, St. Louis, Mo.; S. A. Herbert, St. Louis, Mo.; Joseph F. Hipp, Hamilton Field, Calif.; G. E. Hoffman, Chicago, Ill.; A. E. Holstedt, Chicago, Ill.; Laurence F. Honnicutt, Fort Knox, Ky.; Oliver B. Hove, Vancouver Barracks, Wash.

Edward A. Illsche, Long Island City, N. Y.

R. J. Jones, Edgewood, Md.; George Joslin, Fort Hamilton, N. Y.

Lewis Kaldizar, Metuchen, N. J.; Donald P. Keel, San Benito, Tex.; Stephen Kelly, Fort H. G. Wright, N. Y.; R. B. Kerr, St. Louis, Mo.; Edward V. King, Presidio of San Francisco, Calif.; John Kundrath, San Pedro, Calif.

P. E. Lakin, St. Louis, Mo.; William E. Leighty, Metuchen, N. J.; Hubert duB. Lewis, Watertown, Mass.

Wilkie T. Maddox, Floral Park, N. Y.; William F. Malone, Fort T. E. Warren, Wyo.; John J. McCarthy, Fort H. G. Wright, N. Y.; C. R. McDaniels, Ogden, Utah; Ronald A. McLain, Ogden, Utah; J. F. Miller, Jr., Cambridge, Mass.; P. R. Mork, Chicago, Ill.; LeRoy Mote, Elgin, Ill.; Emory J. Moxley, Orchard Park, N. Y.; Joseph F. Murphy, Fort Ontario, N. Y.

Hal C. Nank, Chicago, Ill.; Herbert A. Nelson, Schenectady, N. Y.; John C. Nelson, Metuchen, N. J.; William Newman, St. Louis, Mo.; C. B. Nolte, Chicago, Ill.; Frank R. Nuckols, South Bend, Ind.

John A. Petroskas, Sparrows Point, Md.; M. T. Pflueger, Fort Rosecrans, Calif.; Benjamin W. Pope, Fort Brady, Mich.; T. Albert Potter, Chicago, Ill.

Jermain F. Rodenhauser, Cambridge, Mass.

Howard D. Schaeffer, Chicago, Ill.; Niels Schultz, Jr., Millbrae, Calif.; Henry D. Scott, Wheeling, W. Va.; Victor Showalter, Elgin, Ill.; F. H. Skelly, St. Louis, Mo.; R. O. Slattery, St. Louis, Mo.; Lloyd F. Smith, Benicia, Calif.; Joseph J. Southard, Sparta, Wis.; G. Radcliffe Stevens, Elgin, Ill.; P. E. Stringer, Elgin, Ill.; George Sutherland, Long Beach, Calif.; S. E. Swain, Houston, Tex.

Lyman W. Tondro, Palo Alto, Calif.

Frank D. Urie, Elgin, Ill.

J. R. Van Rensselaer, Cleveland, Ohio.

William F. Weise, Omaha, Neb.; B. L. Whelan, East Hartford, Conn.; A. A. Whitesell, Presidio of San Francisco, Calif.; William J. Wylie, Fort George Wright, Wash.

Warren B. Zika, Hackettstown, N. J.

NECROLOGY

NOTICE has been received of the death of the following members of the Association: John S. Eynon, Chester, Pa.; James J. Humphreys, Montreal, Canada; C. E. Mundorff, Cleveland, Ohio; and C. R. Seymour, Simsbury, Conn. To their relatives and friends ARMY ORDNANCE extends the Association's condolences.

Ordnance In Review

"STEEL JACKETS" AND "DUM-DUMS"

BY LIEUT. COL. CALVIN GODDARD, *Ord. Res.*

THE average user of firearms pays little heed to his ammunition—unless it fails him. Then he curses it roundly and swears never to buy more of the same make. (As a matter of fact, the fault lies just as often in the weapon as in the cartridge.) He is interested neither in the manufacture of its components nor how these may be assembled so long as it will "go off" and the projectile strike somewhere near where he wishes it to. To him all bullets with shiny (tinned) surfaces are "steel jacketed" (and this quaint idea reaches even to our State Department, which some time since, placed restrictions upon the exportation of "steel-jacketed" ammunition of military calibers!).

FIG. 1. *Left to right:* The .303 Enfield cartridge, Marks IV, V, VI, VII.

As a matter of fact, no steel-jacketed bullets are made in the United States, nor ever were (save perhaps experimentally), except some of the earlier issues for the Krag. They *are* produced in Europe, but in steadily diminishing quantities. British makers, like the American, appear always to have looked askance at them. But in Germany and Austria they long have been in favor. Why this was, and is, goodness knows. Even when coated with a thin plating of softer metal, as they usually are, steel jackets mean wear on the gun bore and plenty of it. But, fortunately, their days appear numbered.

Another expression widely used and applied by most sportsmen to any and all varieties of soft-point (partly metal jacketed) bullets, and to many other types as well, is "dum-dum." Just what is a "dum-dum"? The prevailing impression appears to be that any bullet which is so constructed as to upset considerably on striking human or animal tissue is a "dum-dum." If this be true, then almost any of our good old black-powder-driven sporting bullets was, in effect, a "dum-dum," for its diameter before firing was equal to that of the modern small-bore soft-point bullet after impact, and this was likely to be doubled if it encountered a large bone. As a matter of fact, the only true "dum-dum," according to the best available advices, was a full metal-jacketed, *hollow-point* bullet for the .303 British Enfield service rifle, which derived its name from its place of manufacture—the official arsenal at Dum-Dum, India. Known as the Mark IV (and followed by a Mark V, almost identical), it was produced for use in those occasional exchanges of pleasantries between British frontier troops in India and certain tribes of the hills to whom Hague Conventions were documents more to be honored in the breach than in the observance. Widely made accusations that this bullet was used against the Boers in the South African War, appear to have been groundless.

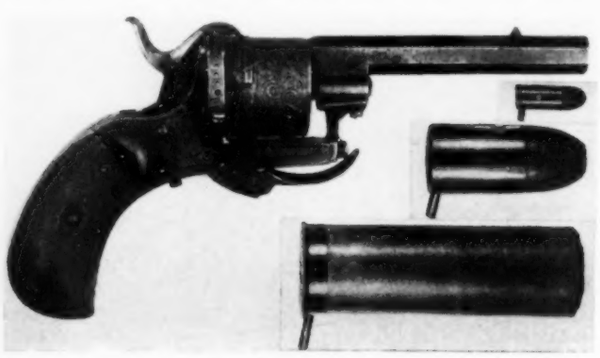

FIG. 2. *Top to bottom:* (1) 5-mm. pin-fire revolver; (2) 5-mm. pin-fire revolver cartridge; (3) 15-mm. revolver cartridge; (4) 12-gauge pin-fire shotgun cartridge.

FIG. 3. *Top to bottom:* (1) Cal. .41 Williamson deringer; (2) Auxiliary steel shell for same; (3) Cal. .41 short rim-fire cartridge for same.

The Mark IV cartridge is obsolete today as are its successors, the Marks V and VI, the latter of which had a round-pointed bullet like the Krag, while the current British service cartridge carries the Mark VII, with spitzer point. The four types mentioned, Marks IV, V, VI, and VII, are illustrated in Fig. 1.

And so, if you pride yourself upon being correct, do not designate as a "steel-jacket," any bullet which doesn't jump at a magnet. And apply the term "dum-dum" to the Mark IV (or Mark V) .303 Enfield service cartridge, and to none other!

ANOTHER subject upon which shooters are vague is pin-fire ammunition. Most modern sportsmen have no idea of such a cartridge, having never seen, or even heard of one. Yet tens of thousands of arms—pistols, revolvers, shotguns, and an occasional rifle—chambered for these are circulating about the country, and not a few of them, the shotguns particularly, are in active use. The pistol and revolver sizes long were made by the Union Metallic Cartridge Company, of Bridgeport, Conn., and the shotgun types widely imported and to be had in any sports store. The pistol and revolver cartridges ranged from 5-mm. to 15-mm. (almost caliber .60), while the shot shells paralleled in gauge scale those produced with central priming. Specimens of the 5-mm. and 15-mm. revolver cartridges, alongside a 12-gauge shot shell, appear

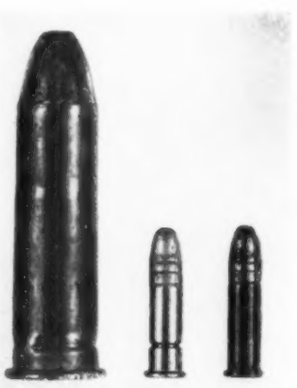

FIG. 4. *Left to right:* (1) .50-70 center-fire cartridge with "inside" (concealed) primer; (2) .22 long-rifle center-fire cartridge with "inside" primer; (3) .22 long-rifle rim-fire cartridge, conventional type.

FIG. 5. *Left to right:* (1) Cal. .31 Theur-Colt revolver cartridge; center-fire; reloadable. (2) Cal. .31 "teat" cartridge; priming element in the small appendage at base; nonreloadable. (3) Cal. .31 "cup-based" cartridge; priming element in cone-shaped recession base; nonreloadable. (4) Cal. .31 "lip-fire" cartridge; essentially a rim-fire, but with rim reduced to a short arc.

in Fig. 2. The loaded pin-fire revolver of 5-mm. caliber, also shown, serves to illustrate the type of arm designed for ammunition of this nature.

Scarcer than the pin-fires, yet good American products all (the pin-fire system is essentially European), are the Theur-Colt cartridges, the teat cartridge, the cup-based variety, and the "lip-fire" (Fig. 5). These are all revolver cartridges of the transition period (1860-1880) when the muzzle-loader was going out and the breech-loader coming in. Incidentally, the first three types shown were inserted from the *front* of the cylinder, the firm of Smith and Wesson holding at that time a basic patent upon revolvers with cylinders loaded from the rear.

Still other devices of this period were weapons designed to operate *either* with loose powder and ball or with metallic cartridges. One of these appears in Fig. 3. This is a "Williamson" deringer, caliber .41 rim-fire, made in Brooklyn, N. Y., in the late sixties and early seventies. With it came a steel cylinder surmounted by a conventional nipple, shown beside it. Lacking fixed ammunition, the shooter filled this with powder, capped it, and placed it in the chamber after first having shoved a lead ball ahead of it into the breech. The breech face of this arm is pierced in its center by a hole which envelops the nipple of the steel shell as the action is closed. The tip of the nipple extends almost, but not quite, far enough rearward to contact the shank of the hammer when the latter is in the "down" (forward) position. When capped, the added thickness of the cap head projects just far enough to engage the shank as the hammer falls thus causing its discharge. The caliber .41 rim-fire cartridge shown in Fig. 3 illustrates the type of metallic ammunition employed in this weapon.

Turning to rifles, we find some of the famous old Ballards, caliber .38 rim-fire, operating almost identically with the Williamson. But instead of being supplied with a steel shell for loading with loose components, they met the problem more simply. Here the hunter, after discharging it, took his last metallic cartridge case and drilled a hole in its center. Using this as his powder charger, he then proceeded as with the deringer. These arms were

FIG. 6. *Top to bottom:* (1) .22 center-fire rifle cartridge; (2) .600 center-fire rifle cartridge; (3) 2-mm. automatic pistol.

FIG. 7. *Left to right:* (1) 2-mm. rim-fire revolver cartridge; (2) .46 rim-fire revolver cartridge; (3) 5-mm. center-fire revolver cartridge; (4) .577 center-fire revolver cartridge; (5) 2-mm. center-fire automatic-pistol cartridge; (6) .45 center-fire automatic pistol cartridge; (7) .455 center-fire automatic pistol cartridge.

made with a nipple, in addition to the regular rim-fire firing pin, screwed into the breechblock and in line with the axis of the bore.

Another curiosity of the early metallic-cartridge era was the inside-primed, center-fire cartridge, the smooth head of which, with no evidence of central priming, deceives many today into believing it a rim-fire. Here the primer, seated in a disc of the same diameter as the inside of the shell, was inserted from the *mouth* of the latter, dropping into place by gravity. Its encircling disc was then staked in position so that it could not slip forward and cause a misfire by two partial cannelure grooves just above the shell head and opposite each other (Fig. 4). Thus were made our first .50-70 service cartridges (and other types as well). Today we see the same principle revived in the manufacture of the .22 long-rifle *center-fire* cartridge overseas. This exactly duplicates its conventional .22 rim-fire prototype save for primer construction (Fig. 4).

In caliber range, we encounter surprises of all sorts. Thus, among rim-fire rifle types, we find on the "short" end, the .22 "B.B. Cap," and on the "long," the .58 rim-fire Gatling cartridge.

Among rim-fire revolver sizes we swing from the 2-mm. to the .46 long rim-fire; in central-fire automatic-pistol ammunition we find the 2-mm. Kolibri contrasted with the .45 Colt and .455 Webley; and in centrally primed *revolver* cartridges we go from the 5-mm. to the .577 (Fig. 7).

Rifle sizes in center-fire ammunition offer comparison between the .22-10-45 (.22 extra-long center-fire), and the .600 cordite, with its *900-grain* metal-cased bullet propelled by 110 grains of smokeless powder at 1950 foot seconds and working up a muzzle energy of 7950 foot pounds, or considerably more than three times that of our service Springfield with 150-grain bullet! By way of contrast, the 2-mm. Kolibri automatic pistol is shown beside the .600 cartridge (Fig. 6).

Yes, there's much to be said on the subject of ammunition.

(All cartridges and weapons illustrated are from Colonel Goddard's private collection. Photographs kindness of Lieut. John H. Fowler, Arms Expert, Metropolitan Police Department, Washington, D. C.)

EDITOR'S NOTE: Several years ago ARMY ORDNANCE published a series of five articles on "Proof Tests and Proof Marks" by Colonel Goddard. These studies, with replicas of proof marks used in the United States and the principal foreign countries, have been acclaimed in the opinion of experts as the most comprehensive analysis of the subject in print. In response to popular demand, this series of articles was reprinted in booklet form which is constantly requested by students of small arms here and abroad. The text contains more than 300 drawings of proof marks in addition to complete data on the proof charges used in official tests in England, on the Continent and in the United States. The supply of these studies is limited and the purpose of this note is to suggest that all who desire copies should order them promptly. The brochure is sold by the Army Ordnance Association at $3.00 a copy. Requests should be addressed to the Editorial Offices, Suite 806 Mills Building, Washington, D. C.

Ordnance Field Service

FIELD SERVICE PROBLEMS, PART I

BY LIEUT. COL. RAYMOND MARSH, *Ord. Dept., U. S. Army**

This article was prepared prior to the recent issuance by the War Department of a tentative Infantry division organization, and was based on army organization as it then existed. The new organization, which is to be tested this summer, corrects many of the faults discussed in this article. After the results of the tests are made public, we hope to publish a series of articles covering Ordnance service in this new division. The 10th Ordnance Service Company has been organized, since this article was written, to provide Ordnance Service for GHQ Air Force units. The organization of this company differs in many details from that herein proposed, but the general principles underlying its functions and operations remain unchanged.—EDITOR.

EVER since the World War there has been an almost continuous presentation of the Ordnance problem. In numerous lectures, articles, and discussions we have been regaled with facts and figures concerning hundreds of thousands of tons of supplies, millions of rounds of ammunition, and billions of dollars of estimates. We have been faced with data in figures of well-nigh astronomical proportions. An investigation of this presentation shows that it concerns only the Ordnance procurement problem. The Ordnance problem, however, includes more than procurement—stupendous though that phase may be. The Ordnance problem involves Field Service quite as well, and that is a phase which is not so readily reducible to terms of dollars, tons, and items. I wish to avoid meticulously, the creation of any suspicion that I am attempting to belittle the Ordnance procurement problem. Little though I know of that problem, I well know its size and its ramifications. But at least the existence of the Ordnance procurement problem is known, and its nature is understood to some degree. When we come to consider the Ordnance Field Service problem, however, we find that very little is known about it; some even question the existence of such a problem, and it is only within the last few years that it has been discussed to any extent.

Let us start our discussion of this problem by considering what Field Service is. There is no one place in the War Department publications in which the Field Service functions and responsibilities of the Ordnance Department are set forth completely. By legislation and regulation, the Ordnance Department, in general terms, is charged with the "provision and distribution, and maintenance and repair, of certain prescribed articles, including, generally, all arms, armament, ammunition, tanks, special Ordnance vehicles, bombs and other equipment and supplies" for whose procurement, storage and issue, the Department is made responsible. The duties of unit Ordnance officers are enumerated in the current edition of the Staff Officers' Field Manual, Part I, 1932.

Excluding all procurement functions which are performed by Ordnance Department agencies in the form of Zone of the Interior establishments and facilities, all Ordnance services with mobile forces at all camps, posts and stations, in all fortifications, and in the theater of operations must be discharged by those agencies of the Ordnance Department pertaining to the Field Service Division of the Department.

*This discussion presents the personal views of the author and does not represent official policy on the subject.

Ordnance Field Service was established originally by General Order No. 80, War Department, June 1919, "for the supply and maintenance of such matériel as is, or may be, allotted to the Ordnance Department." This original order was subsequently modified during the next four years by several War Department General Orders, all of which were finally rescinded when AR 45-30 was published. This Army Regulation, last revised under date of January 16, 1934, defined the Ordnance Field Service as "that branch of the Ordnance Department charged with the supply, the maintenance in service and in storage, and the operation and inspection of such matériel as is, or may be, allotted to the Ordnance Department for storage and issue."

From a consideration of these facts it can be stated that Ordnance Field Service performs the following duties: (1) The supply and distribution of Ordnance matériel, except artillery ammunition to all units in the theater of operations, down to and including the regiment, or corresponding independent units; (2) The supply and distribution of artillery ammunition down to and including refilling points; (3) The repair of Ordnance matériel in all echelons when such work is beyond the capacities and capabilities of the facilities and personnel available in the units themselves; (4) The gathering of technical information concerning the proper use and defense of our own matériel, also, any new developments or improvements of enemy matériel; (5) The custody of captured enemy ordnance.

To perform these duties and accomplish these missions, the Ordnance Department Field Service is provided with personnel which includes Ordnance officers of corps areas, departments, divisions, expeditionary forces, coast defenses, camps, posts, and stations, with their military assistants, whether members of the Ordnance Department or not, together with the civilian and enlisted forces authorized and provided; all Ordnance organizations which may have been or may be formed for the supply and maintenance of Ordnance property; all Ordnance personnel attached to or detailed with the arms or other service organizations, and Ordnance personnel under the control of the Chief of Field Service at all Ordnance establishments and in general and area depots.

LET us review briefly the set-up of Ordnance Department troop units with the mobile forces. In the type organization in the army troops, there is an army Ordnance service group consisting of an appropriate headquarters which belongs to and is mobilized as a part of army headquarters, three Ordnance ammunition companies, one Ordnance maintenance company, and three Ordnance depot companies. It is the function of the ammunition companies to provide the administrative and supervisory personnel for army ammunition establishments. The primary function of the maintenance company is the operation of a small-arms repair center. The depot companies operate such Ordnance general supply depots as may be established in the army area.

In the corps, in the special troops organization of the corps, there is an Ordnance heavy maintenance company and an Ordnance ammunition company. It is the function of the ammunition company to provide administrative and supervisory personnel for such ammunition installations as may be established and operated by the corps. It is the function of the heavy maintenance company to support the medium maintenance companies in the lower echelons of the corps organization and also to perform the maintenance functions for the corps troops. In addition, there is in the corps artillery brigade an Ordnance maintenance company whose function is primarily that of maintaining the Ordnance matériel pertaining to the brigade.

In the Infantry division, in the division special troops, there is an Ordnance maintenance company of medium characteristics. It is the primary function of this company to maintain and repair Ordnance matériel of all classes pertaining to the division. This company orginally was organized and equipped with this primary function only in mind, and its basic organization and equipment

have not been changed materially, although its function may have been increased and amplified.

In the Cavalry division, in the division special troops, there is also an Ordnance maintenance company of light characteristics. The functions of this Cavalry division Ordnance maintenance company are similar to those already described for the Infantry division maintenance company, and the same remark applies.

From a consideration of the normal duties of these several type Ordnance companies, the enumeration of the duties of a unit Ordnance officer referred to above, and the missions of Ordnance service, it will be seen that in addition to such functions as pertain to the technical nature of the duties of a special staff officer, Ordnance personnel, organizations, and facilities must perform services which consist of supply and maintenance. However, due to the hazardous nature of ammunition, the special features of ammunition supply and its vital importance, ammunition supply has been separated from general supply. Consequently, Ordnance Field Service has three functions to accomplish; *viz.*, general supply, ammunition supply, and maintenance.

There is general agreement as to these three main types of Ordnance service. But when we come to consider the extent and scope of these functions, the methods and manner of their performance, and the personnel, organization, equipment, and other facilities needed to discharge these duties, then we encounter confusion, contradiction, dissension, and uncertainty. The elimination of this chaos is the real Field Service problem.

Our war-time experiences with Field Service are practically limited to the World War, when we operated under the very special and peculiar conditions of stabilized warfare in an old country thickly populated and well developed, with a transportation net of both railroads and highways which had been laid out with strategical military operations in mind, and with the aid of a military plant that had grown up during more than three years of sanguinary warfare in the same theater. The solutions which were applied to service problems under those conditions would not have been as satisfactory under the conditions of, let us say, the Palestine campaign. It is unfortunate that so much study is being devoted to the operations of the Western Front and so little to the other theaters. The operations of these other theaters contain many valuable lessons for all military students.

SINCE our Ordnance Field Service has been in existence, our Ordnance service problems have been solved more or less satisfactorily because of the special conditions incident to peace-time existence. Almost every post has an Ordnance detachment which discharges all Ordnance supply problems, both general supply and ammunition supply. Maintenance is satisfactorily performed, due to our resident machinists in harbor defenses, our corps area civilian inspection and repair crews, our several Field Service depots, all of which exercise modification, alteration, and repair functions, and our several maintenance companies. These maintenance companies, however, almost universally have degenerated into overgrown post Ordnance detachments operating more or less elaborate, permanent machine shops with the assistance of expert civilian mechanics. Take these mobile maintenance companies away from their posts, strip them of their expert civilian aids, make them operate with the mobile field equipment which they actually possess, and divest mobile forces in the theater of operations of the maintenance services of the zone of the interior corps area Ordnance crews, and the aspects of your maintenance situation will be absolutely and completely changed. And the change, I fear, would not be for the better.

The problem of general supply for mobile field forces, assuming that ample supplies are forthcoming from the zone of the interior, is the simplest of our three problems. Let us discuss it first. The function of general supply was imposed upon the unit Ordnance officers by the 1928 edition of the Staff Officers' Field Manual. When this function was imposed, no additional facilities were authorized or provided to meet this obligation. In the typical army organizations, the only Ordnance organizations that are capable organically of discharging supply functions, are the three depot companies included in the army Ordnance service. These companies normally establish and operate such general supply installations as may be required by the army.

It must be noted, however, that the tables of organization for this type company include no transportation for depot functions, and provide personnel only for the operation of the depot. Only under the most exceptionally favorable circumstances are these companies able to establish a depot without additional assistance in the form of both labor and motor transportation. These depot companies should be provided with adequate transportation of both light and heavy types for depot operations, to transport replenishment of stocks from railroads to depots, to make deliveries of Ordnance general supplies to lower echelons or units, to expedite salvage and, when necessary, to afford the means for setting up advanced echelons of the depot. In lower echelons of the army, the only Ordnance organizations provided are ammunition companies and maintenance companies. The chief means at the disposal of Ordnance officers are the maintenance companies. The organization of these companies has not been changed in any respect since the additional function of general supply was imposed upon unit Ordnance officers. The result is that if the unit Ordnance officer uses these maintenance troops to discharge the function of general supply, maintenance personnel must be diverted from their normal functions.

IN time of active operations, it is considered that the demand for Ordnance general supplies normally will be small. Such items of Ordnance supplies as may be required for the individual may be met almost completely, it is felt, from the salvage from the battlefield. The big need for supply, then, will be limited largely to items of organizational equipment. The very nature of this equipment, however, is such that none of it can be transported in reserve. In this connection it is worthy to note that in the reserve of supplies carried by the other services, practically no organizational or individual equipment is transported in the status of what we are pleased to call "rolling reserves." Such Ordnance general supplies of the nature of organizational equipment items as may be needed in active operations, can be supplied, it is felt, through the medium of some form of delivery service. By that we mean that the organization charged with this supply function should receive the requirement from the organization, proceed with its own transportation to the proper point of supply, obtain the item, and deliver it to the organization. A supply section organized and equipped so as to be able to render this service should be provided in the set-up for Ordnance service, particularly in the division.

During periods of inactivity, or while the unit may be in rest areas, the demands for Ordnance general supplies may approximate a general reëquipping of the unit. For such general reëquipping, it cannot be expected that the organic Ordnance personnel charged with the mission of supply will be adequate, or in fact that it should be adequate. Such a general reëquipping is neither an ordinary nor a regular procedure. It may become a frequent procedure, as during the World War, but such reëquipping will take place ordinarily in rear areas adjacent to more or less permanently installed supply establishments, and in such cases it is considered that the additional personnel required should be met by details of the proper personnel from these supply points, or from higher service commands.

The problem of general supply, then, requires clarification of thought as to the type of Ordnance supply service needed, particularly in the division, how this will be effected, and what facilities must be provided. The Office of the Chief of Ordnance has recommended that the transportation authorized for a depot company be increased to provide the types of transportation for the several missions which I noted above, and that there be created in the division some type of a supply group. (*Continued.*)

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Professional Notes

SOME NOTES ON STOPPING POWER

BY LIEUT. SAMUEL S. YEATON, U.S.M.C. AND KELLY YEATON

THE problem of stopping power and its causes eventually worms its way into every discussion of military side arms and often causes immediate deadlock as it is a subject of which little is known and about which nothing can be proved. The work that Lagarde and Thompson did in 1904 is still the best-controlled series of experiments designed to throw light on the question. Their conclusions that sectional area and delivered energy are major factors in the estimation of stopping power still stand as authoritative. The controversies in the past thirty-three years have been largely within the terms "sectional area" or "delivered energy." These factors obviously attempt to measure the energy and type of blow given by the bullet to the body, but the "British Textbook of Small Arms" (1929) states that the wounding effect of small-caliber high-velocity bullets has come to depend less upon the blow struck and more upon the destruction of tissue. This element should, of course, be considered with all types of projectiles, although it was formulated for the semi-explosive effects of projectiles moving at velocities above 2000 feet per second.

Consideration of the energy of the blow gives us two variables: the weight of the bullet and the velocity at which it arrives at the target. In the absence of data to the contrary it generally has been assumed that the stopping power of a bullet varies directly with the changes in energy derived from differing velocities, assuming other conditions to be the same. It now appears that this assumption may be in error. There seems to be some ground for assuming that there is an optimum velocity for pistol bullets, and that this velocity may be somewhere in the close vicinity of the speed of sound; that is to say, about 1100 feet per second.

It is recognized that this is a critical velocity in the private life of a bullet as a study of curves of velocity plotted against air resistance will show ("British Textbook of Small Arms," 1929, p. 285). Below 1000 and above 1200 feet per second the curve travels smoothly enough, but between these speeds there is a curious quirk, not fully accounted for by the scientists. The change in slope above and below this area is easily explained, for below 1000 feet per second the bullet travels behind the sound wave from the muzzle blast and is therefore moving in disturbed air, which appears to have less restraining effect on the bullet than the undisturbed air in which it travels at velocities above 1200 feet per second. The action of the curve between these velocities indicates that something interesting goes on here, although the exact characteristics of that something may be a subject for speculation. Whether or not these phenomena are actually related to stopping power is beyond the present power of the writers to determine, but we wish to present a coincidence for the theorists to chew on. Scientific coincidences have, in the past, assayed very high in nutriment.

Dr. Posnett, in an article in the London *Lancet* (Sept. 1914), comments from his experiences in the Boer War that at ranges above 900 yards the smashing power of modern rifle bullets becomes greater than at the middle ranges and compares the effects with the explosive results at short ranges. He reports that bone injuries of the most serious magnitude may be expected, whereas at ranges between 300 and 900 yards the bullet

seems to penetrate with little comminution. DaCosta, in quoting this article in his text on "Military Surgery" (1925), adds the information that at 1500 or 2000 yards the bone will again be penetrated without comminution, as a general rule.

AT first inspection, these reports may seem contradictory, but in actual fact they are not. They divide the trajectory into bands, within which similar effects may be expected. The first is the short-range band where semiexplosive effects occur. These effects are to be expected at velocities above 2000 feet per second. This band ends somewhere around 300 yards. The second band lies between 300 and 900 yards, and here great penetration is to be expected, and bone, if struck, will probably be cleanly perforated without smashing. The stopping power of such wounds is usually relatively small, partly because of the lack of tissue destruction, and partly because the bullet carries much of its energy with it when it leaves the body, instead of expending it in the wound. A third band, with a nearer limit somewhere around 900 yards and extreme limit somewhere short of 1500 yards, seems to be an area within which the bullet again possesses great smashing power. Bone is broken with great comminution and corresponding shock effect.

The fourth band begins somewhere short of 1500 yards and extends beyond 2000 yards. Within this band the bullet again perforates without smashing.

The translation of these rather indefinite areas into terms of velocities presents some difficulties, as we do not know definitely what bullets form the basis of these conclusions, but if we wish to accept the hypothesis that DaCosta, in publishing Posnett's conclusions from the Boer War, implies that the surgeons of the Great War found no reason to disagree with this earlier work, then we may find some significance in the following table which shows various range velocities for the cartridges used on the Western Front and some others which may have entered into the experience of many World War military surgeons.

CARTRIDGES USED ON THE WESTERN FRONT:

Cartridge	*Nation*	*Muzzle Velocity*	*Velocity at 900 yds.*	*Velocity at 1500 yds.*
.30-'06.....	U.S.	2700[1]	1155[1]	850*
.303 Mk. VII.....	England	2440[2]	1060[2]	800[2]
Balle D.....	France	2380[2-3]	1200*	920*
7.9-mm. Mauser flat-base.....	Germany	2882[2]	1200*	880*
SOME OTHER CARTRIDGES:				
7.9-mm. Mauser boat-tail.....	Germany	2400[3]	1240*	960**
.30-'06 Mk. I.....	U.S.	2600[1]	1276[1]	950*
.30-'03.....	U.S.	2200[2]	1006[3]	790[3]

1 From Training Regulations 1350-A.
2 From "The British Textbook of Small Arms," 1929.
3 From E. C. Crossman: "The Book of the Springfield."
4 Estimated from elevations reported by Crossman as used in long-range tests comparing .30—'06, Balle D, and experimental boat-tail projectiles.
* Computed by means of the "Graphic Charts for Small-arm Ballistic Computations," by Macon Fry, Ordnance Engineer, Ford Instrument Co.

It will be observed that these figures tend to place our third band very close to the quirk in the air resistance curves, between 1000 and 1200 feet per second. It will also be noted that all bullets are well out of this zone by the time they reach 1500 yards, even the boat-tail Mauser which was particularly used for long-range machine-gun work.

Elmer Keith, who probably has more information regarding the effects of handgun loads on game than any other American,

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prefers and recommends loads which chronograph at about 1100 feet per second, as he finds that they have as much killing power as many rifle loads carrying heavier bullets at higher velocities. Mr. Keith's experience may not have the laboratory surroundings of the Chicago stockyards, and there are, of necessity, many uncontrolled factors, but the use of wild game instead of steers as targets may conceivably be a nearer approximation to a human opponent. That is obviously a matter of opinion.

Deputy Commissioner Fairbairn of the Shanghai Municipal Police, who has collected a large amount of data regarding the effect of several types of handguns when used against Chinese criminals, is of the opinion that at least 1000 feet per second is necessary for good stopping power.

LIEUT. COL. J. S. HATCHER in 1933 recommended the use of caliber .22 high-speed hollow-point loads in 2-inch-barreled revolvers for personal defense, in place of caliber .38 loads in guns of similar description because of superior power of destroying tissue. Here, of course, one point for consideration is the fact that the .38 penetrates the body and carries much of its energy with it, while the .22 uses all of its energy within a short distance of the surface of the body because of the deformable bullet. Even so, there is much more to be accounted for, especially if one considers the accepted basis for estimating stopping power as sectional area and energy, for even the deformed .22 will not be much larger than the .38. We observe that Colonel Hatcher reports he was obtaining nearly 1000 feet per second at the short ranges he used for testing these .22 high-speed hollow-point loads.

An examination of the ballistics of many of the guns that were famous as game-getters in the days when velocities had not reached the lower limit necessary for explosive results will often reveal that the velocity of the projectile, at ranges most commonly used, was within our limits. As an example, let us take the old buffalo guns. These guns were required to knock down a buffalo with a single shot, as the hunters had no cartridges or time to waste. Since the report of the rifle would disturb the herd if the hunter was within a range of 300 yards, the usual ranges were those between 300 and 400 yards. The so-called Sharp Buffalo or .45-120-550 used a bullet which left the muzzle at 1400 feet per second. Four hundred yards away it was still doing 1020 feet per second. The older Sharps, which did a large part of the actual buffalo killing, was the .40-90-370. This bullet left the muzzle at 1500, was doing 1100 at 300 yards, and 1025 at 400 yards. These cartridges were perhaps the most popular of those days, but there were many others used, of course, some of which show similar velocities.

ANOTHER projectile with a reputation for knocking down its game is the shotgun slug. These slugs are preferred by hunters of European boars as they hit with tremendous power at the short ranges at which these boars are shot. The desirability of stopping the charging boar does not need to be pointed out. The Brenneke slug is reported by Krogius to have a velocity of around 1180 feet per second 5 meters from the muzzle. It has satisfactory accuracy up to 60 yards where it is still traveling a trifle over 1000 feet per second.

Some of the old black-powder expresses so popular in Africa show similar bullet speeds at actual ranges, and there are very probably many others which will do the same. If any of our readers should have figures on other guns with reputations for knockdown ability, we would be interested in them whether they seem to be favoring or adverse.

We do not claim that there *is* a velocity near which the shock effect is greater. We do not have sufficient grounds for such a statement, but we think that we do have warrant enough to claim that there *seems* to be such a velocity. We sincerely wish that someone would carry out the experimentation necessary to determine whether this is a fact or just simply a chimera.

METAL FOULING WITH LEAD BULLETS

BY PHILIP B. SHARPE

IN the spring of 1935 a new handgun appeared on the market—the Smith & Wesson .357 Magnum revolver. A description of the development of this new arm and its ammunition appeared in the July-August 1935 issue of ARMY ORDNANCE (Volume XVI, No. 91, p. 29).

With the announcement of the gun and cartridge another major problem cropped up—that of metal fouling. When Winchester introduced the ammunition in this caliber—ammunition now included in the line of all major companies—they discovered that a few rounds of the most powerful cartridge ever manufactured commercially for a revolver would smear the barrel the entire length with lead.

In the two years that this gun has been on the market, more than 2000 shooters have discovered that the leading, for the most part, has not been limited to isolated cases, but is more or less universal. Apparently, in the supervelocity loading of an unjacketed revolver bullet, a new series of unknown factors enters into the picture, and since the general trend of modern ammunition development is toward higher and still higher velocity, the solution of the .357 Magnum problem has a direct reaction on future high-speed ammunition developments.

When high-speed ammunition is used in a rifle, there is little jump of the bullet into the rifling itself. The revolver presents an entirely different problem. The bullet must leave the case mouth and jump through the mouth of the cylinder into the throat of the barrel. The latter is "funneled" considerably in an effort to permit the bullet to properly align itself into the rifling. In leaving the case mouth, and in making this jump into the barrel throat, the bullet upsets to a diameter far greater than normal, and is then reswaged down to groove diameter. This reswaging apparently creates the problem of leading.

By way of verification, tests have been made with a caliber .22 target revolver with barrel removed entirely from the frame. The long-rifle cartridge was used and the bullets recovered by shooting into suitable material. In some cases these bullets would expand so that they contacted the threaded part of the frame, in many cases upsetting to as much as caliber .38, all within the first half-inch of travel after leaving the mouth of the cylinder.

Working on this theory, it would seem that a proper alloy might solve the problem, and all the standard accepted alloys for cast and swaged nonjacketed bullets were tried. Strangely, hard bullets seemed to lead more than the soft. The quantity of leading varied somewhat with different alloys, but was still present, regardless of bullet material.

Armed with this information, the writer endeavored to solve the problem to his own satisfaction, and in this research had the full coöperation of Winchester, Smith & Wesson, the Hercules Experiment Station, and the Acheson Colloids Corporation. Many dozens of different loads were developed, until finally up popped the theory that lubrication was the answer.

IN recent years, handloaders dealing with high-velocity rifle ammunition have discovered that accuracy frequently can be improved through the use of grease wads back of the bullet. This grease wad consists of a thin sheet of a specially compounded grease, wax, or other mixture which is pressed over the case mouth with the fingers, thus punching the wad. The bullet is then seated on top of the wad in the customary fashion. There are more different grease-wad formulas used today than anyone would care to recount, but the idea dates back to black-powder days when target fans discovered that accuracy could thus be improved. As a matter of fact, research indicates that the grease-wad idea was used back in 1780.

There is one very important factor in the proper use of grease wads. In bottle-neck cartridges the wad must remain in

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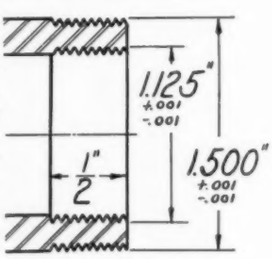

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the neck of the case and not drop into the powder chamber. Its use, therefore, is limited to certain bullets that do not seat too deeply in the case neck.

In the straight-case .357 Magnum revolver cartridge, this problem does not exist. Experimental work was conducted to check these ideas. In every case, the use of a grease wad eliminated leading entirely. Several different formulas failed to show any difference in results. Laboratory tests made by Hercules indicated that with a bullet seated to properly compensate for the thickness of the grease wad, there was no noticeable effect on pressure. In rifle calibers, experiments have shown clearly that grease wads in maximum loads create a dangerous and alarming increase in breech pressures.

A problem solved in this manner is, of course, of very little value to the manufacturer of machine-loaded ammunition. The application of a grease wad would involve rather costly operation and expensive machinery. Since the experiment showed that lubrication was the answer, further research was conducted.

In grease-wad research for rifle ammunition, the writer discovered that the so-called graphite-containing mixtures could be improved greatly through the use of colloidal graphite in place of the customary powdered material. Graphite, in its colloidal state, is so much more finely divided that the pressure of the gases seems to drive a portion of the colloidal mixture into the pores of the steel, thus reducing the erosive effect of the hot gases, at the same time providing a more or less self-lubricating interior surface to the barrel.

Based on this experience, the writer enlisted Mr. William A. Lamb of the Industrial Products Company of Boston, in the development of a suitable lubricant. Numerous formulas were tried until the final one was adopted for detailed experimental work. This mixture consists of Oildag, 4 drams; castor oil, 2 drams; beeswax, 4 drams; Japan wax, 12 drams; and petrolatum, 1 dram. It was found that the consistency of this mixture could be controlled by the period of blending.

EXTRACTS from rather lengthy reports run as follows:

"Barrel B. Twelve shots only. Standard Winchester factory load. Uniform leading, similar to that observed by the writer in examining several dozen barrels, fired with standard factory load. Leading appears to be entirely in the grooves and not on the lands. Thin streaks and less leading on the driving side of the lands. No leading in the cone. Begins about one inch in front of barrel throat. Very little in middle of barrel. Rather patchy near the muzzle. Equally distributed in all grooves. . . ."

"Barrel E. Fired with load B 5, standard Winchester bullet lubricated by Winchester and backed by thin grease wad, Donaldson formula, made by R. R. Sherman, McLean, Va. Barrel, on careful examination fails to show any traces of leading, either in grooves or in corners of grooves. . . ."

"Barrel F. Fired with load B 6, 146-grain Sharpe hollow-point cast bullet single groove, alloy 1 to 20, tin and lead. Ideal lubricant. Grease wad used with same formula as in load D 5. Barrel absolutely free of any traces of leading, except three closely grouped patches in the center of one land one and one-quarter inches from breech. One little smear of lead .109-inch long. Two others .030- and .016-inch long. Width of all three .014-inch. Appears to be small shaving from crimp blown into the barrel and run over by a bullet. Not typical leading. . . ."

"Barrel G. Ammunition lot B 7, 146 Sharpe hollow-point bullet. Grease wad omitted. Typical leading load and was fired as check. Barrel shows leading in all grooves on driven side. Noticeable traces from breech to muzzle. Not evenly smeared. Tiny patches and clumps of lead. Streaks of tiny lumps on three of the lands within one and one-half inches of breech. No leading on lands at the muzzle. Some leading in center of groove, unevenly distributed the entire length of the barrel. This load verifies that when grease wad is used leading can be eliminated. . . ."

AOA

Chronicle

THE newly formed unit of the GHQ Air Force—the 10th Ordnance Service Company—will be commanded by Lieut. Col. Russell L. Maxwell, GHQ Air Force Ordnance Officer. The duties of the Company will be highly specialized since it will be called upon to supply Ordnance matériel, such as machine-gun ammunition and bombs to combat squadrons for loading in airplanes, as well as pistols and machine guns for the ground defense of the six air bases. The Company also will repair aircraft machine guns. It will be composed of 167 enlisted men and eventually 8 officers. It will be divided into six platoons and distributed to the six air bases—Langley Field, Va.; Mitchel Field, N. Y.; Selfridge Field, Mich.; March Field, Calif.; Hamilton Field, Calif.; and Barksdale Field, La.

The Navy has announced that work on fifty-two of the sixty-five warships now under construction is running behind schedule. Work has not begun on eight 1500-ton destroyers and three submarines. Completion of the aircraft carrier YORKTOWN will run about two months behind the scheduled date of March 18th while work on the carrier ENTERPRISE is also behind schedule. Work on the WICHITA, the only heavy cruiser under construction, is about four months behind schedule.

Maj. Gen. Hugh A. Drum has been assigned to command the Sixth Corps Area at Chicago upon completion of his present tour of duty as commander of the Hawaiian Department. He will succeed Brig. Gen. Charles D. Herron, temporary commander.

Maj. Gen. John H. Hughes, Assistant Chief of Staff, has been ordered to command the Philippine Division at Fort William McKinley, Philippine Islands. Maj. Gen. John L. DeWitt, former commander of the Philippine Division, has been assigned to duty as Commandant of the Army War College, Washington, D. C.

THE British Government intends to raise up to four hundred million pounds for defense purposes within the next five years, it was announced by Neville Chamberlain, Secretary of the Exchequer. One of two White Papers published after this announcement gave a broad outline of the 1937-1938 program for the Army, Navy, and Air Force. It stated that the two new capital ships being built under the 1936 naval construction program were costing about eight million pounds each and that three more capital ships would be ordered. Seven new cruisers and two aircraft carriers were expected to be included in the 1937 program, the cost of which would be much higher than the fifty million pounds estimated for the 1936 program. Navy personnel would be substantially increased. Two new Army tank battalions would be provided, Army conditions made more attractive, equipment modernized and the Territorial Army enabled to train with the same types of weapons as the Regular Army. The Air Force program includes the acquisition and preparation of many new airdromes and the building of over seventy-five operational and training stations at home and abroad.

Budget estimates for 1938 provide funds for one year's training of only 500 Reserve officers next year instead of the annual quota of 1000 specified in the original Thomason Act. It is believed, however, that Congress will approve additional funds to give 1000 Reserve officers one year's active-duty training with units of the Regular Army, after which 50 of these officers will be selected for permanent commissions in the Regular Army.

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been detailed as students at the Army Industrial College, Washington, D. C., for the 1937-1938 course; they will report in August, 1937: Lieut. Col. A. S. Buyers, Lieut. Col. C. Waldman, Maj. John Huling, Jr., Maj. H. E. Minton, Capt. W. D'Espinosa, Capt. G. K. Heiss, Capt. L. C. Leonard, Capt. A. S. Rice, and Capt. D. J. Crawford.

FOLLOWING exhaustive tests by the Air Corps in conjunction with the Infantry, Artillery and Cavalry over a period of approximately 1½ years, the War Department has purchased six autogiros at a cost of $238,482.18, including spare parts. Each autogiro is powered with a 225-horsepower radial engine and has a speed of about 125 miles per hour. In landing, the ships can clear an obstacle 50 feet high and stop within 150 feet of the obstacle. They will be used by the Infantry, Artillery, and Cavalry for reconnaissance, observation of fire, communication, and command missions.

An independent Air Corps within the War Department would be set up by a bill sponsored by Representative Wilcox of Florida. The measure would establish the Air Corps as an equal national-defense component with the Army under the Secretary of War and would provide for its entire separation from the Army in budget, supply, training, personnel, and procurement.

The House of Representatives has authorized the award of bachelor of science degrees to all living graduates of the Military and Naval Academies. The bill is designed to amend an act passed in 1933 authorizing the Military, Naval and Coast Guard Academies to confer degrees only from the date when these institutions were placed on the accredited list of the Association of American Universities.

A BRAND-NEW service tradition was inaugurated at Fort George G. Meade, Md., by the 66th Infantry—the only tank regiment in the Army—when it decided to honor Regimental Commander, Col. Bruce Magruder, by naming for him the first of the new light tanks received. In the presence of all the officers and ladies of the regiment the new tank was brought forward, escorted by its sister tanks of the 1st Platoon, Company A, and was christened by Mrs. Magruder, wife of the regimental commander, who broke a bottle of champagne over the front armor plate of the tank, naming it "Bruce Magruder"—a name it will carry throughout its service on a bronze plaque on the turret. In continuance of this tradition, a tank will be named for each new colonel the regiment receives.

A bill making it a criminal offense to make photographs, maps or sketches of vital military or naval installations or equipment has been passed by the Senate. This legislation, sponsored by the War and Navy Departments, gives the President authority to decide what "installations and equipment" require secrecy, and thereafter it becomes a crime to photograph or sketch them without permission.

Factory workers of Soviet Russia commemorated the nineteenth anniversary of the Red Army by announcing that they are devoting their spare time to the study of military tactics preparatory to converting themselves into war-time fighters. Four hundred and fifty tractor-combine operators declared that they were learning tank operation.

The British Government is planning to recruit 200,000 men and women throughout the country as auxiliary volunteer firefighters to protect London and other crowded centers of population and industry from incendiary bombs dropped from enemy planes in the event of a future war.

Although Secretary of the Navy Claude A. Swanson has announced that the Navy will not decide to use 16-inch guns on its two proposed 35,000-ton battleships until the naval-armament intentions of all nations are known, it appears likely that the vessels will be armed with nine 16-inch guns as a result of Japan's rejection of the proposal that she join other leading naval powers in limiting the caliber of guns on capital ships to fourteen inches.

AOA

Book Reviews

WE CAN DEFEND AMERICA. By Maj. Gen. Johnson Hagood, Garden City, N. Y.: Doubleday, Doran & Co., Inc. 1937. $2.50.

GENERAL Hagood said he would retire and write a book on how to defend America efficiently and economically. He has done so. Many of his arguments are undeniably irrebuttable; some of his proposals will be given grave consideration; some of his ideas, however, will provoke serious disagreement. But what more can be said in recommendation than this: that when the reader has begun he cannot stop; that when he has finished he will remain in prolonged meditation?

Chapter I contains a pragmatic philosophy on war. In conclusion the author asserts that we should have: (1) A high-sea navy second to none; (2) A permanent and powerful system of seacoast harbor defense to seal our principal ports against all foes, and to serve as bases for the fleet; (3) An air corps of reasonable size, up to date, not a great many planes, but always the best planes; (4) An army conceived and organized, *not* as they do it in Europe, but in accordance with the genius of the American people—a defensive army to repel invasion—not a football of politics.

In the chapter on Invasion he writes: "If you owned a hog and a patch of potatoes, you would build a fence around the hog or potatoes, or both. You would not hire a man (army) to watch the potatoes (America) and drive off the hog (invader) after he has begun to root." A strong navy and seacoast defenses are the "fences" around the "hog" and "potatoes" respectively. The Army should be a mobile reserve.

Chapter III deals with the Navy; Chapter IV is lucidly entitled: "The Seacoast Defenses Are A Pile of Junk" (Amen); Chapter V: "The Air Corps"; Chapter VI: "What Kind of Army?" The General discusses the size of the Army in Chapter VII. "America's greatest need in time of war is weapons; after that, men who can use these weapons." We do not need to train a pick-and-shovel corps in peace time. The horse is passé. Training should be: first, *weapons and tactics;* then administration; not the reverse. Close-order drill breeds discontent and destroys initiative (Amen). Too much nonsense in and time wasted on "Saluting And So Forth" (Chapter XI). "The Army should follow the practice of the Navy, where these matters are developed in a normal natural way," says the General.

Especial attention is called to discipline. Close-order drill has no place in modern battle, and is therefore wrongly applied in time of peace. No honest student of procurement planning can disagree with the views expressed on munitions. "Our system in time of peace should be workable in time of war."

The author goes on to discuss service schools, the National Guard, the Reserve, and citizens' training. He believes that the training of Reserve officers is handicapped by antiquated methods; that much valuable time is wasted in teaching Reserve officers the peace-time customs and practices of the Regular Army. The concluding chapters deal with building programs and a proposed reorganization of the War Department. With reference to the latter—"it is too big; it is top-heavy." The personnel is excellent, the machinery terrible.

In truth, General Hagood has "written for the consideration of those who come after (the World War), who have an earnest desire to avoid the mistakes of the past, and who, without partiality, favor, or affection, want to do what is best for the future."

M. M. J.

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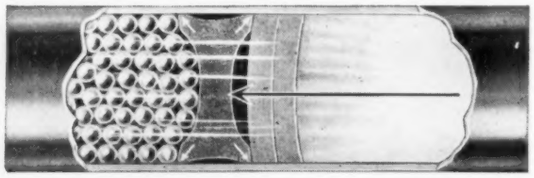

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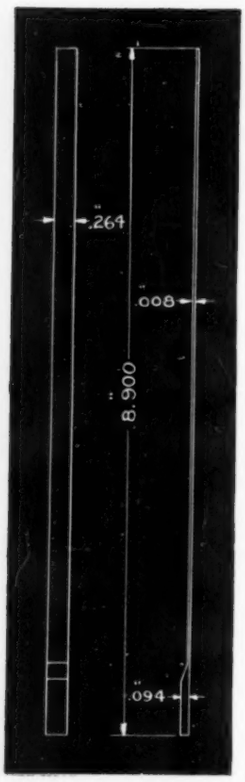

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GENERAL GRANT'S LAST STAND. By Horace Green. New York: Charles Scribner's Sons. 1936.

THIS book developed from the discovery of more than a hundred letters and memoranda written by General Grant during the latter part of his life to his physician, Dr. J. H. Douglas—the author's great-uncle. This material finally fell into the hands of Mr. Green who, from writing reviews and reading practically all of the Grant literature on record, had come to suspect that many historians completely failed to appreciate General Grant's real emotions, mentality and military ability.

These letters and memoranda put such an entirely different aspect on the character of General Grant and portrayed him to be so entirely different from the so-called "mathematical butcher of Cold Harbor," that Mr. Green felt moved to build this book around them. For that decision, all students of Grant's life and military operations must be grateful.

We agree with the author "that a man who could carry on a slip of paper tracings of his youngster's hand and secretly exhibit them to his cronies at a lonely Army post at Humboldt Bay. . . . a man who would spend the first night of the Battle of Shiloh sitting under a tree in the rain rather than go to a field shelter because, in his own words, 'the sight was more unendurable than encountering the enemy's fire'; a man who, toward the end, would write farewell messages to his wife and pin them to his clothing; who would deliberately kill himself in a race to pay creditors and to provide a rich competence for the family he had already served so well . . . . must have a deep fund of reserve characteristics . . . . and, though perhaps lacking in political subtlety and evasiveness, must have been more sensitive to current thought than generally supposed."

Although this book can add but little to the literature of General Grant's military thought, doctrines, and operations, it does cover some phases and events of his life after he had left public office that are not so generally known. To the student of military affairs, it will have value chiefly as a character study and, as such, its friendly, but nevertheless fair, discussions are invaluable.

R. M.

MATERIALS HANDBOOK. AN ENCYCLOPEDIA FOR PURCHASING AGENTS, ENGINEERS, EXECUTIVES AND FOREMEN. By George S. Brady. New York: McGraw-Hill Book Company, Inc. 1937. $5.00.

TWO points of especial interest are to be mentioned at the start. The author is Lieutenant Colonel Brady, Ordnance Reserve, who is well known to the Ordnance fraternity. He served with distinction in the Ordnance Department, A. E. F. Among his "honorable mentions" should be included his part in founding *Mehun News*, one of several forerunners of ARMY ORDNANCE, which was published at the American Ordnance Base Depot, Mehun-sur-Yevre. He was formerly managing editor of *Product Engineering* and of *American Machinist*, and formerly American Trade Commissioner to South American countries. He is now technical adviser to the President's Coördinator for Industrial Coöperation.

The other special point is that this 1937 issue of the "Handbook" is its third edition. Previous editions were published by the same renowned firm, the McGraw-Hill Company, in 1929 and 1931.

More than three thousand materials are cited in this work, beginning with "Abrasives" and ending with "Zirconium-ferro-silicon." Accuracy, authenticity, and correct nomenclature have been prime considerations in this revision. New materials have been added. While not a metallurgical handbook, general information on the chief ores and most important industrial chemicals has been included to make available a basic background for more intelligent judgment of materials. Here is a random selection of the treatment given a subject:

"Gun metal. The common name for a casting bronze con-

taining on an average 88 per cent of copper, 10 of tin, and 2 of zinc. It casts and machines well, and is suitable for making steam and hydraulic castings, valves, and gears. It has a tensile strength of 32,000 to 45,000 lb. per sq. in., and an elongation of 15 to 30 per cent in 2 in., with reduction of area of 12 to 25 per cent. The specific gravity is 8.7, and the weight is 0.315 lb. per cu. in. The Brinell hardness varies from 65 to 74. This alloy is the same as the 'G bronze' of the U. S. Navy.

"Gun-metal ingot marketed by H. Kramer & Company, may have the zinc replaced by 2 per cent of lead. Such an alloy is easier to machine, but has less strength. The 'gun metal' used by the Pennsylvania Railroad for armature bearings averages 91 per cent copper and 9 tin.

"A gun metal used by the British Admiralty for ordnance castings subject to shock is a bronze containing 90 per cent copper and 10 tin. 'Modified gun metal' contains lead in addition to the zinc. It is used for gears and for bearings. A typical modified gun metal made by William H. Barr, Inc., contains 86 per cent copper, 9.5 tin, 2.5 lead and 2 zinc. It has a tensile strength up to 40,000 lb. per sq. in., elongation 15 to 25 per cent, Brinell hardness 63 to 72, and weight 0.31 lb. per sq. in."

The reviewer might have selected tung oil, or Ni-Hard, or keepchar, or any of the more than three thousand subjects from this handy but none-the-less monumental compilation which should be of great value to the industrial executive (who has not the time for consulting a general encyclopedia) the engineering student (who may have the time but not the inclination) and for all others in industry and engineering (who may have neither time nor inclination but who are compelled to do so the better to earn a living in the collective sweat of their collective brows). As was to be expected, Colonel Brady has done well and many a consultant of this work will thank him for it.

L. A. C.

TOGO AND THE RISE OF JAPANESE SEA POWER. By Edwin A. Falk. New York: Longmans, Green and Company. 1936.

THE history of the world affords few instances of a national hero who, within the span of his own lifetime, saw his nation progress from medievalism to modern civilization, from isolation to parity. Such, however, was the lot of Togo Heihachiro, better known to the world as Admiral Togo.

When the Samuraian Togo was born in 1847, Imperial Japan was a feudal nation, isolated from the rest of the world by the sea, the suspicions of her own people, and imperial edict. When Togo died in 1934, Japan was a world power. Her industrial organization rivaled both Great Britain and the United States, she had penetrated far into Asia, and exercised unquestioned naval supremacy in Asiatic waters.

All of this was largely possible because of the Imperial Japanese Navy which, more than any other one man, Togo had developed.

It is popularly believed that the visit of Commodore Matthew Perry, U. S. N. to Japan with a few postrevolutionary naval ships was a gala affair, that the trade gates were immediately thrown wide open and amicable diplomatic relations set up. Had it been so, one wonders what the history of the Far East would have been. To the contrary, Japan was humiliated as China had been—with only this difference—Japan fought back. War between Japan and Great Britain resulted. The town of Togo's birth, Kagoshima, was bombarded and burned. In this engagement, the boy Togo received his baptism of fire, and at the hands of the British.

By one of those peculiar quirks of destiny, Togo was trained for the sea a few years later by the British in their training ship WORCESTER and returned to Japan to become a leader in that marvelous development of Japanese sea power. The next sixteen years "constituted the period of his life between preparation and celebrity, the years when the gilt of his uniform was not reflected in any halo, when he did the day's work merely

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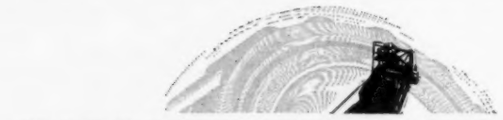
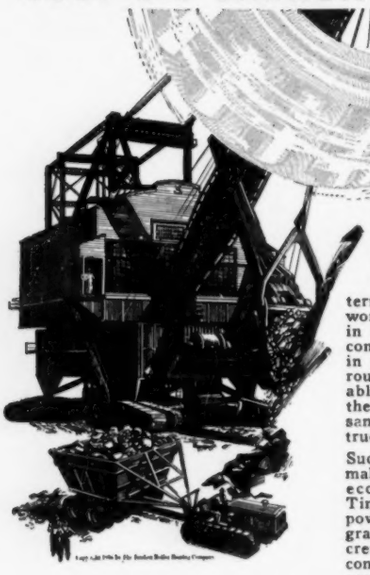


MACHINES THAT ENDURE
ROLL ON TIMKEN BEARINGS



You'll find Timken Tapered Roller Bearings on the really tough jobs everywhere because they ENDURE. For example: Timken Bearings carry the terrific loads handled by the world's largest power shovel; in fact, throughout the entire construction field—an activity in which machinery takes the roughest punishment imaginable—you will find Timken the dominant bearing. This same Timken supremacy holds true throughout ALL industry.

Such striking evidence must make you see the downright economy of insisting on Timken Bearings when buying power shovels, excavators, graders, wagons, tractors, concrete mixers, pavers, pumps, compressors—and all kinds of construction machinery.

THE TIMKEN ROLLER BEARING COMPANY, CANTON, OHIO

TIMKEN TAPERED ROLLER BEARINGS

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HIGH EXPLOSIVES FOR
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as one of the many valued officers in a growing navy." Then came the "Kowshing" episode which, but for the date, might be taken for an account of German naval operations in the last war. War with China over Korea followed, with the destruction of Chinese naval power in a battle in which Togo played no little part.

And, then, only a few years later, came the crowning achievement of Togo's career—the utter destruction of the Russian fleet in the Straits of Tsushima in one of the few great naval battles of modern times. This war over, Togo ended his service afloat with a parting speech that so impressed President Theodore Roosevelt that he had Togo's farewell address published to the United States Army and Navy in general orders.

This book is more than a biography. It is a scholarly exposition of one of the most dramatic and significant national developments in modern times. It is a careful narrative and critical analysis of a series of naval operations—Hakodate, Yalu, Wei-hai-wei, the Yellow Sea and Tsushima Straits—to which too little attention has been paid. R. M.

I Saw Them Die. By Shirley Millard. New York: Harcourt, Brace & Company. 1936.

THIS is the diary of a nurse in a volunteer unit of the French hospital service, expanded by her recollections some fifteen years after the events recorded. Like most young people, Miss Millard's concept of war was based on Fifth Avenue parades and motion pictures. She had not been in a French hospital long before she found out that war has little glamor and less glory but lots of grime and more grind. These experiences which "debunked" war for her evidently made little impression on her at the time because they are scarcely mentioned in the diary itself. More than half of this book consists of recollections brought to mind only a little more than a year ago when she decided to publish the diary. Apparently, only the most horrible of her experiences lived in her memory and in her recollections they are set forth in all their harrowing details.

Yes, she "saw them die". Some of them died horribly, and some of them had to live still more horribly. But she also saw them live. And she admits that the patients in the hospitals showed her what real nobility was. And her first trip to Paris was one of the high points of her career. I wonder why her recollections did not elaborate on some of the things which, when they occurred, thrilled her greatly? In describing the operations of a hospital, for example, one should not limit their descriptions to the refuse which flows from the operating rooms. Miss Millard's book would have been much more readable had she recalled more of her living contacts and less of her dying contacts.

This is another of those books which strive to prevent war by stressing the well-known horrors of war. But the world is peopled by human beings and those same human beings fight the wars and pay the price. And it is notorious that the majority of us humans will learn only by experience, and not from the experiences of others. So of what purpose is the depicting of horrors? R. M.

Pamphlets Received

The Revolving-cylinder Colt Pistol Story from 1839 to 1847. A fascinating account by James H. Edgerly of the four unique Colt-Walker-Collins revolver models that bridge the Colt data gap of that period. With six illustrations. Published by F. Theodore Dexter, Topeka, Kan.

The Battery in Charleston, South Carolina. Historical Commission of Charleston, 1937. 25 cents. A panorama of three centuries of history viewed from Charleston's famous battery with descriptions and photographs of the guns and monuments. Prepared by Maj. Alfred H. von Kolnitz, formerly an Infantry officer of the United States Army.